ENGINEERING
JAN 20 1948

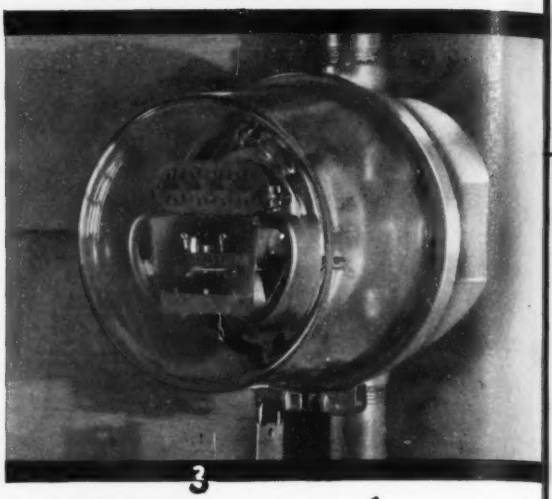
Electrical World

A McGRAW-HILL PUBLICATION

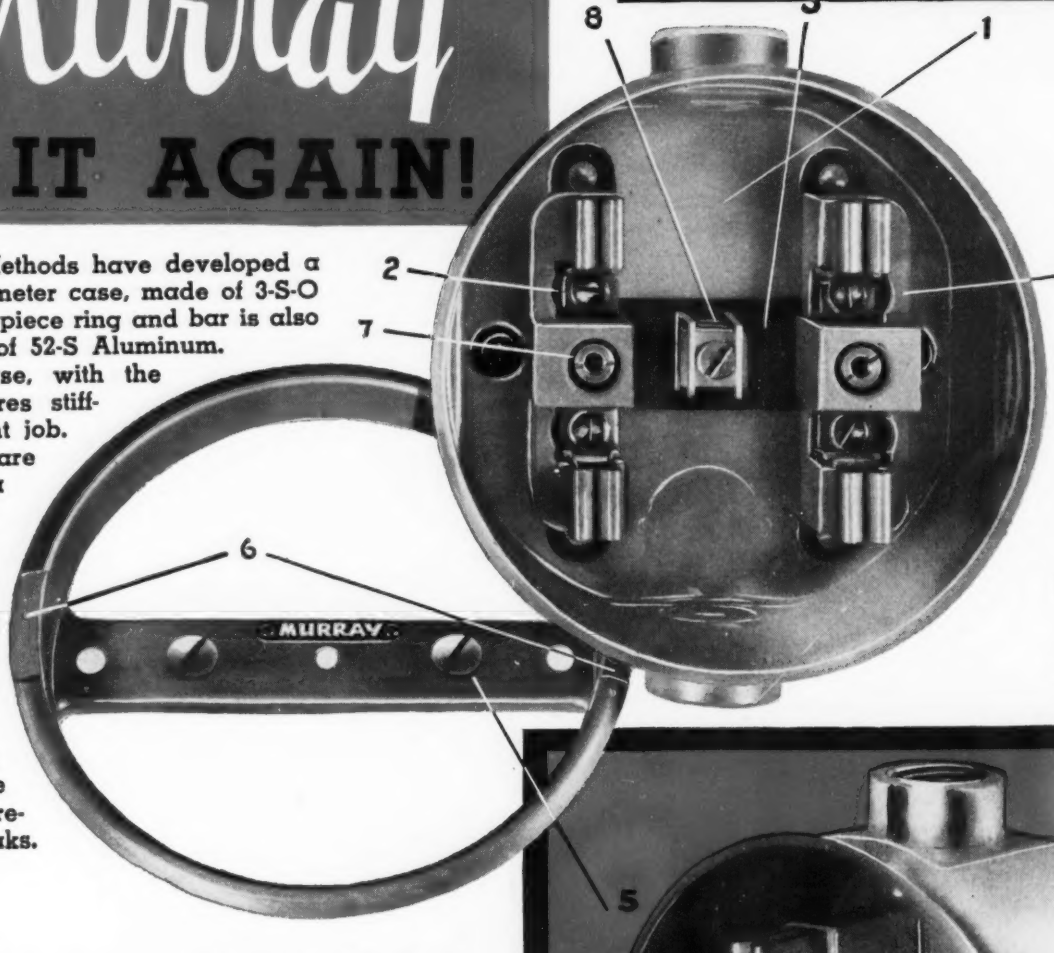
JANUARY 17, 1948

44th STATISTICAL ISSUE

NOW—with ALUMINUM METER SOCKETS



Murray DOES IT AGAIN!

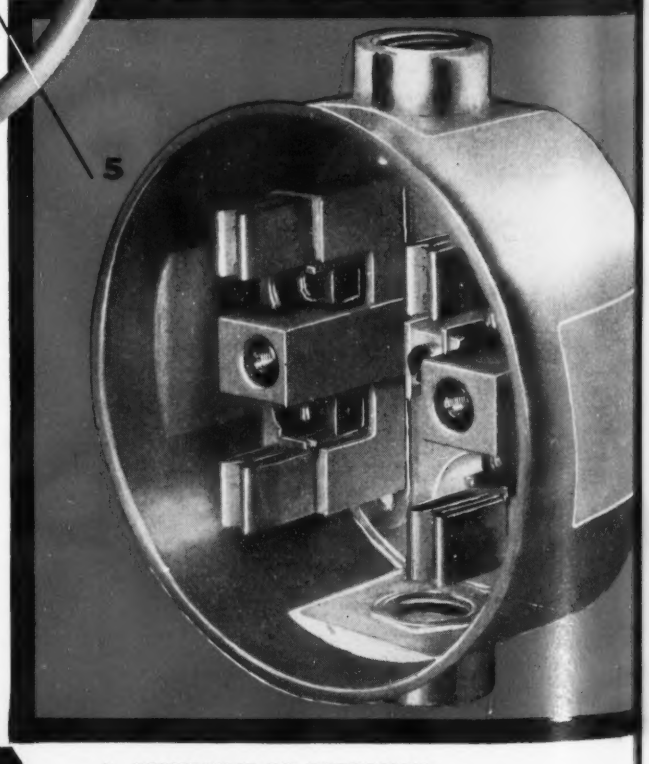


Murray Modern Methods have developed a deep drawn socket meter case, made of 3-S-O Aluminum. The one-piece ring and bar is also deep drawn, made of 52-S Aluminum.

The one-piece case, with the turned-out lip, assures stiffness and a rain-tight job.

Aluminum hubs are specially fitted into a hexagon hole provided in the flat sidewalls. This connection is both rugged and rain-tight because of a special machining operation on the inside of the box. The hexagon-shaped part of the hub on the inside is flared to prevent turning and leaks.

SEND FOR BULLETIN 503



SPECIAL FEATURES

1. Plenty of hand room.
2. Solderless terminals take up to No. 1 wire.
3. Steel spider plate, aluminum-riveted to back of case, holds porcelain and jaws in perfect alignment.
4. Porcelain blocks easily removable by backing out brass screw on top of studs. These studs are anchored in the steel spider plate.
5. Ring and bar easily removable by backing out two screws.
6. Breathers are provided in ring to permit circulation of air.
7. No copper parts come in direct contact with aluminum, preventing electrolytic action.
8. Grounding connection in all cases.

AT THIS TIME ONLY TWO TYPES OF VERTICAL MOUNTED SOCKETS ARE AVAILABLE:

1. Cases with 1" knockout in the back.
   Equipped with a hub at top and bottom.
   Equipped with a hub at top and bottom and one in the right side (three way).
2. Cases without knockout in the back.
   Equipped with a hub at top and bottom.
   Equipped with a hub at top and bottom and one in the right side (three way).

OUTSTANDING CHARACTERISTICS OF 3-S-O ALUMINUM

1. RESISTANCE TO CORROSION
2. WELDABILITY
3. WORKABILITY

METROPOLITAN DEVICE CORPORATION • 1250 ATLANTIC AVENUE • BROOKLYN 16, NEW YORK

Electrical World — Editorials

JANUARY 17, 1948

Whence The Funds

As SOON AS ELECTRIC utilities saw indications of greatly freshened demands for service, they made prompt plans for expansion of facilities. For many months, the increase was pegged at 30 percent. The capital outlay was seen as $5 billion. Later as costs started to rise, it became $6 billion. Even during that period, there was no clear-cut pattern discernible for acquiring the funds needed to provide a 40 percent increase in generating and distribution investments.

Now the astonishing prospect is for a 50 percent increase in generating capacity, (see p. 146). And there must be companion increases for lines, substations, etc. There is a justifiable worry about the financing of this expansion. It, in turn, is compounded by the fact that if generating capacity is boosted 50 percent, the investment to do this will be increased by well over 50 percent. Costs, even if they level off and recede somewhat during the five-year program, will never get back to the 1941 level. That level, in itself, was substantially higher than the average prevailing when most of the industry's plant was built.

Here is a poser, then, for the electric utilities. Where can $8 billion or perhaps $10 billion—not just $6 billion—be obtained in the next four years to pay for the expansion? And once it is known where the money can be had, how can it be obtained? Presently, the answers to these two questions outweigh such problems as rates, or the volume of operation necessary to carry such added investment. The public will be served—or else.

Wouldn't it be delightful if the orthodox ratios of bonds to preferreds to common could be maintained as each addition to capital is made? The trouble is that numerous factors already appear which make it look as if this will be impossible—at the very least, difficult—to achieve.

For one thing, the nation's great glut of savings is being soaked up by high prices. While new capital demands continue or increase, money that was easy has become a lot tighter. Refunding of utility bonds and preferreds at lowered rates has ceased. The rate of return trend on capital is now upward. Money, by any route, is costing more. Bond interest on many recent issues is up half a percent or more. We can't imagine investors accepting a low rate on preferreds.

Insurance companies have taken lots of utility bonds and preferreds. But even they have a limit. Apparently, that limit is being approached. If the rates on utility preferreds fail to keep up with the trend, why should insurance companies risk the possible decline in market value to which preferreds are susceptible.

What to do in the face of such impediments? Well, when conventional techniques look unpromising, the unconventional must be studied. Utility financing probably is going to require inducements which have not been common to the industry's restrained practice. Convertible preferreds or debentures are examples. Perhaps investors will insist upon accumulation of funds to retire preferred issues. ELECTRICAL WORLD has already pointed out the possibilities of installment buying. Through the medium of equipment trusts, which cover retrievable facilities, installment buying of heavy power equipment might well be legal, feasible and even attractive.

Right now, the big compulsion is to recognize that the industry must have a financing plan. As much as $10 billion may be needed within four or five years. It won't be found on trees. It will have to be dug up—with forethought, with organization and with effort.

★ ★ NEWS OF THE

Truman's '49 Budget Allots Nearly 50% More for Power

$1,287,230,110 Asked for 8 Agencies Which in 1948 Have Received $805,384,488—President Urges Approval of St. Lawrence Project—$625,000,000 Is Recommended for AEC

PRESIDENT TRUMAN'S power and allied construction budget for fiscal 1949 totals better than 50 percent above appropriations granted in this fiscal year.

As submitted to Congress this week (Jan 12), the budget gives power construction agencies, including the Reclamation Bureau, $1,287,230,110. Actual appropriations so far this fiscal year were $805,384,488.

Here's how the fiscal 1949 power construction budget compares with fiscal 1948 power construction appropriations:

Agency	1949 Budget	1948 Approp.
Army Engineers (Flood)	$471,683,750	$298,683,750
Army Engineers (R&H)	191,267,000	116,267,000
Bureau of Reclamation	262,615,150	136,644,738
REA (Loan funds)	300,000,000	225,000,000
Bonneville	23,225,000	9,914,000
Southwestern Power Adm.	3,180,000	125,000
Int. Div. of Power	104,610	50,000
TVA	35,154,600	18,700,000
Total	$1,287,230,110	$805,384,488

The President urged Congress to authorize the St. Lawrence seaway and power project "now," but his $39.7 billion total budget included no funds for its construction.

The Atomic Energy Commission is scheduled to expand its programs, with $625,000,000 in new appropriations and authorizations to make contractual obligations totaling $200,000,000 in fiscal 1948 and $400,000,000 in fiscal 1949. Bonneville Power Administration was listed for contract authorizations amounting to $13,050,000 in 1949.

Southwestern Power Administration would earmark $3,000,000 of its request for construction of transmission facilities. SPA will seek authorization to use an estimated $1,105,628 still unobligated from carryover funds.

Interior's Power Division wants $21,509 for "Eastern power marketing" activities. This would cover expenditures for power sales from such Army dams as Clark Hill, Allatoona and Buggs Island. A similar item was rejected by Congress last year.

Modest "cost of living" increases in administrative appropriations were recommended for most of the regulatory agencies. Federal Power Commission was slated for $4,220,000 for this purpose, as against a 1948 appropriation of $3,953,000. Securities and Exchange Commission was alloted $6,000,000, an increase of $261,300.

Noting that both the natural gas and electric utility industries were undertaking large expansion programs, the budget justification for FPC's $267,000 increase asserted it was needed chiefly for handling pipeline and hydroelectric project license applications, and securities issues. But the Commission's burden has been increased also, the statement added, "because of the inability of the electric utility industry to expand their generating facilities to meet increased power demand, and must rely more and more on interconnections to forestall power shortages in certain areas."

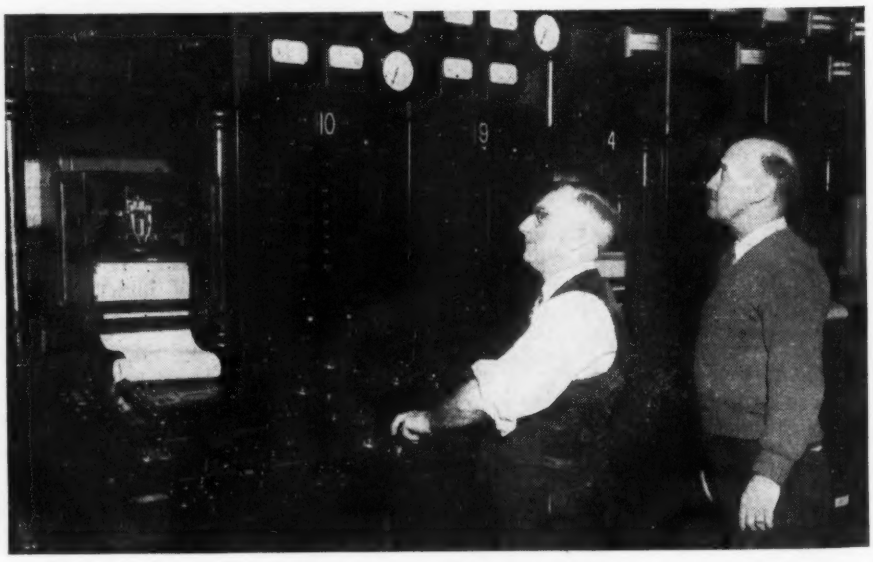
Major appropriations asked for Army power dams included:

Buggs Island, Va.-N. C.	$10,200,000
Clark Hill, Ga.	8,400,000
Allatoona, Ga.	9,900,000
Bull Shoals, Ark.	17,000,000
Fort Gibson, Okla.	9,000,000
Fort Randall, S. Dak.	20,000,000
Fort Peck, Mont.	4,200,000
Garrison, N. Dak.	30,400,000
Wolf Creek, Ky.	19,687,000
McNary, Wash.	30,000,000

Bureau of Reclamation plans to spend $240,661,000 of its appropriations for actual construction. Reason for speeding work on Canyon Ferry Dam, for which the principal contract is to be let in 1949, the budget states, is that "a critical power shortage" exists in that area. The Bureau's budget provides the following amounts for other projects having important power features:

Central Valley, Calif.	$41,500,000
Davis Dam, Ariz.	24,000,000
Colorado-Big Thompson, Colo.	23,000,000
Columbia Basin, Wash.	48,000,000
Missouri Basin	63,900,000
Hungry Horse, Mont.	9,850,000
Anderson Ranch, Ida.	5,800,000
Parker Dam Power, Ariz.	260,000

The Bureau also is seeking author-



NARRAGANSETT ELECTRIC CO has added a 50,000-kw unit at its Manchester Street Plant in Providence, R. I. Stanley J. Hall, left, foreman of switchboard operation, and Operator W. J. Somerville synchronize the new generator with the system for the first time. Total construction cost was $7,000,000

ization to spend $7,113,650 from revenues to operate and maintain power facilities. Congress allowed $4,766,700 for this purpose in 1948. The increase, the budget asserts, is necessary because of the Bureau's "additional generating capacity and transmission line mileage," and "increased purchase of power" to meet "deficiencies in Arizona."

TVA's proposed new steam plant, for which an initial appropriation of $4,000,000 is requested, will be located on the shore of the Kentucky Dam reservoir, near New Johnsonville, Tenn. If Congress approves, the Authority plans to put one 125,000-kw unit (rated capacity, 112,500-kw) into operation in 1951; another early in 1952; and a third, if demand warrants, in 1953.

The Authority also plans to spend $71,697,000 of corporate funds in 1949. It also asks continuation of $500,000 in carryover appropriations. TVA Power program will include continued work on Watauga and South Holston Dams, and on the addition of new generating units at Wilson, Wheeler, Fort Loudoun and Douglas Dams.

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St. Lawrence to Get Prior Consideration by Senate

Proposed authorization of the St. Lawrence seaway and power project will get priority consideration in the Senate this month, Republican leaders have announced.

The bill to be debated in the Senate was introduced last year by Sen Arthur Vandenberg and other senators. It was approved late in the summer session by the Foreign Relations Committee. Hearings on an identical bill, introduced in the House by Rep George Dondero, were started last year by the Public Works Committee of that body. These hearings probably will be resumed around Feb 1.

Official Washington concedes the authorization bill little chance of Congressional approval during the present session. Opposition finally is mounting in the Senate, though it may not be strong enough to stop the measure there. House leaders predict that the bill will get to a floor vote this year—and that it will be defeated when it does.

Increase in Planned Capacity Indicated by Industry Survey

'Electrical World' Study Shows Central Station Capacity Will Be Raised 25,000,000 Kw or 50 Percent—Cost May Run $10,000,000,000—Government Plans Cloud Picture

ELECTRICAL WORLD's annual survey of the electric power industry indicates a real possibility that its current expansion program may:

1. Total 25,000,000 kw, or about 50 percent of today's central station capacity. Previously, a 40 percent expansion has been accepted as the probability.

2. Cost $8,000,000,000 or even $10,000,000,000, rather than the $6,000,000,000 about which the industry has spoken matter-of-factly for months.

The potential 50 percent expansion of generating capacity includes federal plants, both under construction and authorized. Whether Congress actually appropriates for the latter will govern the size of the expansion, to be sure. There is every indication from administration circles that every effort will be made to obtain construction funds for this authorized capacity.

The potential $10,000,000,000 cost assumes a full continuation of today's price levels for at least several years more. This is not a difficult assumption to swallow. The $8,000,000,000 figure contemplates the traditional decline from post-war inflation peaks. Also, both assume that utilities will install the transmission and distribution equipment which will be required to distribute the vaster output of an overall generating capability 50 percent greater than now exists.

One way to rationalize all this is as follows: The electric utility industry today is about a $15,000,000,000 industry. If it were to increase all its plant and equipment by half, the cost, at the composite price levels which governed existing plant, would be $7,500,000,000.

Of course, not every last type of equipment need be doubled. Thus, the true cost would be something less than $7,500,000,000. That was the genesis of the $5,000,000,000 and later, $6,000,000,000 figures at which the expansion program has been set for months.

But today, the proposed expansion of generating capacity has become so great that a lot of reinforcing of transmission and distribution lines, as well as a lot of new and strengthened substations become inevitable. Thus, the industry will be forced to expand nongenerating plant before it has finished the spurt in expanding generating plant. Inevitably, this will boost the cost of the overall expansion program . . . and the required capital.

Add to this the heavy increase in power system costs, and the erstwhile $6,000,000,000 program rises ominously. The most informed guess to which ELECTRICAL WORLD has access is that already mentioned—$8,000,000,000 or even perhaps $10,000,000,000. The dependence of the latter figure on a continuation of today's price level, of course, is obvious.

As to whether all or most of the government capacity which has been authorized but not appropriated for will, in fact, be built, there obviously is a real question. But everything points to a strong administration demand for it. The largest government power operator — Interior — has been crying power shortage for years. The next largest—TVA—is calling for new generating equipment all over its system. The Rural Electrification Administration is beating the drum continuously for more co-op-owned generating plant. The President referred recently to "power shortages" imposing "ceilings" on increased industrial and agricultural output. This came in a speech which demanded a vast industrial and natural resource expansion. The speech was followed within the week by a record peace-time budget which boosted power construction funds by 50 percent.

As for Congress actually appropriat-

GEORGE W. HAGGARD, second from right, is sworn in as assistant administrator of the Rural Electrification Administration. Others from left to right are Administrator Claude R. Wickard; John W. Asher, chief, Personnel Division of REA; and William Neal, deputy administrator

ing the funds, it did little cutting last year on power construction funds—in spite of an economy mandate. It has already approved one deficiency appropriation for the Reclamation Bureau. In a presidential year, and as dependent on the West as it is for victory, the Republican majority just doesn't figure to reduce power spending greatly this year.

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$1,000,000 in Claims Arise from Utility Reorganization

Claims amounting to more than $1,000,000 have been filed in the Federal District Court in Portland, Ore., for services in connection with the Portland Electric Power Co's reorganization.

This follows closely the announcement that the U. S. Supreme Court has refused an appeal by the first preferred stockholders that the reorganization plan as approved by bond and shareholders and Oregon courts was unfair. However, filing of the new suit will not affect final steps in the reorganization, which has been pending since 1939.

Among the claims on file are: Ralph H. King, attorney for independent trustees who ask $107,000; Thomas Delzell, one of two independent trustees who seeks $146,650; R. L. Clark, the other trustee, who asks $109,435; the Guaranty Trust Co, N. Y., which asks various fees for special services and expenses amounting to $363,000; Pepco bondholders committee, $50,000; prior preferred stockholders' attorneys, $150,000; and attorneys for the bondholders' committee, $150,000.

Federal Judge James A. Fee is expected to take steps within a few days to put the reorganization into effect.

Electrical Manufacturers Indicted for Price Fixing

Ten of the nation's biggest electrical manufacturers were indicted by a Federal grand jury in Los Angeles, Jan 12, on charges of conspiracy to fix prices in sales to public utilities. The indictment charges criminal conspiracy. Justice Department agents said they would show that both municipally and privately owned utilities lost millions of dollars as result of alleged conspiracy.

The government also filed civil action in Federal District Court in Los Angeles, asking a restraining order to prevent ten defendant companies from "further price fixing and acts in restraint of trade."

The defendant companies are: General Electric Co, Westinghouse Electric Corp, Delta-Star Electric Co, A. B. Chance Co, Hi-Voltage Equipment Co, Pacific Electric Manufacturing Corp. Railway & Industrial Engineering Co, Southern States Equipment Corp, Electrical Engineers Equipment Co, and Cole Electric Co.

The grand jury indictment specifically charges that defendants illegally restrained trade by fixing "artificial and non-competitive prices" in sales of disconnecting switches, ground switches, and other items of equipment to public utilities. Buyers affected, according to government spokesman, were Department of Water & Power of Los Angeles and Imperial Irrigation District of California.

Assistant Attorney General John F. Sonnett, head of Justice Department's Anti-Trust Division, was in Los Angeles personally for the investigation and returning of the indictment.

The case was one of opening guns in California's anti-trust campaign that Sonnett personally heralded a few weeks ago when he said that California might be the scene of more such cases than any other state because of its expanding industry.

The anti-trust chief explained in a statement accompanying this indictment that forthcoming investigations on the West Coast "will include all important municipal purchasing involving interstate commerce with particular attention directed to submission of identical, non-competitive bids, and other restrictive practices by industry."

Welcome Rain

The greatest 24-hour increase in water stored in the Shasta Dam reservoir, near Redding, Calif., was recorded early last week. The increase was 41,000 acre-ft. A three-day gain of 71,000 acre-ft boosted storage at the reservoir to 2,364,000 acre-ft. The Bureau of Reclamation reservoir has a total capacity of 3,700,000 acre-ft. Water is badly needed to raise output of the power plant.

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More Soft Coal in 1947

Production of bituminous coal in the United States reached 619,000,000 tons in 1947, a preliminary estimate of the Bureau of Mines indicates. In 1946, when there were two strikes, production was 533,922,000 tons.

REA Tells Older Co-ops to Do Own Bookkeeping

Congressional Committee Advised Such Procedure Last May—REA to Check Construction Loans

The Rural Electrification Administration has notified 76 of its older borrowers that they must take over a portion of their own bookkeeping.

Auditing of cooperatives' accounts by REA field representatives has been a part of the special services rendered new borrowers by the lending agency since its inception. Now well-established co-ops will take over auditing of their general accounts, though REA will continue to keep tabs on construction loan accounts.

Intentionally or otherwise, the action could not have been timed better to improve REA's status with Congress. The agency soon will go before the House Appropriations Committee to justify its annual budget requests. Last year, the committee sharply admonished REA for what it termed attempting to "spoon-feed" its co-op borrowers. The House body directed the agency to cut down its services to co-ops which could handle the same jobs.

REA sources contend that they have been working out means to comply with these instructions ever since they were issued by the committee last May. The agency already has instructed its field representatives to discontinue regular visits to individual co-ops, they reported. The field men have been directed to aid the co-ops only in emergencies or when assistance has been requested.

Auditing services were curtailed for all co-ops which have attained two points of development: (1) when the average "weighted" age of their facilities is five years or older, and (2) when they have assets equal to 25 percent of the value of their properties. Assets include repayments made on REA loans and depreciation funds accumulated for that purpose. All 76 co-ops notified to take over their general accounts own 25 percent of their properties, and another 25 may be qualified, REA spokesmen said.

However, the auditing notice directed the co-ops to hire only certified public accountants approved by REA. The accountants also must employ methods similar to the modified version of FPC's uniform system of accounts applied by REA to co-op books.

Other co-ops will take over their books as they attain the specified qualifications, REA officials said. They added that the agency felt it must continue to check loan accounts to follow spending of actual funds advanced by the government.

What REA Did in 1947

Approved loans of $233,991,000 or $57,064,000 less than in 1946.

Ended the year (Dec 10) with a backlog of applications of $265,000,000 in comparison with $231,000,000 on the same date in 1946.

Passed the $1,000,000,000 mark in loan approvals and the 2,000,000th consumer mark in connections to REA-financed lines.

What REA Borrowers Did in 1947

Extended service to 346,000 farms and other rural establishments. Previous peak for extensions was 274,983 in 1946.

Borrowed $219,270,000, about $87,000,000 more than in any previous year.

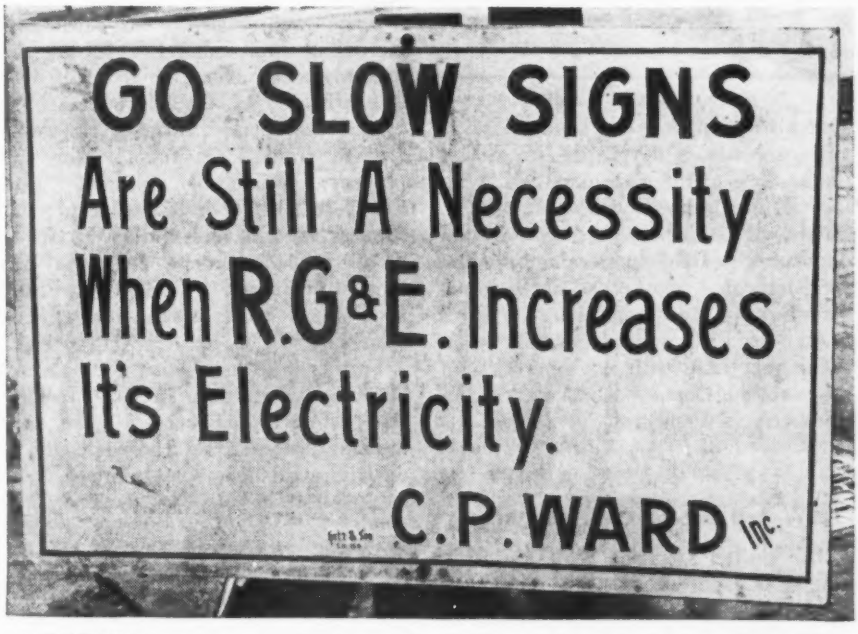
Energized 87,000 miles of distribution lines and "heavied up" many more miles to handle increased loads.

Increased annual energy usage per customer 12 percent to 1,794 kwhr from 1,602 kwhr.

Increased the annual energy bill per consumer from $57.61 to $61.18 while the revenue per kwhr dropped from 3.60 to 3.41 cents.

Increased (77 REA borrowers) generation by 23 percent (74,087,000 kwhr) from 319,913,275 kwhr in 1946 to 394,000,000 kwhr in 1947.

Bought 3,695,000,000 kwhr in 1947, an increase of 35 percent or 964,735,000 kwhr more than the 2,730,264,776 kwhr bought in 1946.



C. P. WARD, contractor on Rochester Gas & Electric Corp street projects, is using poetry on street barrier warning signs. He has paid his employees for nearly 100 suitable verses at $10 or more a verse. The signs amuse motorists and have cut liability claims nearly 70 percent

Council Bluffs, Ia., Defeats 20-Year Utility Franchise

A proposed 20-year franchise for the Western Iowa Power Co has been defeated by the voters of Council Bluffs, 3,228 to 1,162. The opponents of the franchise asserted that it was a means toward establishing municipal ownership by subterfuge.

The utility is owned by the Omaha Electric Committee, a non-profit Nebraska group, which acquired it from the Nebraska Power Co. Council Bluffs has an option to buy the utility. One of the terms of this agreement, which expires May 1, is that the 20-year franchise be approved.

Iowa Power & Light Co is also interested in purchasing the property.

Nitzberg's Nifty Number Nips Nostradami

Dead these two years and more, the Office of War Utilities smiled from its tomb this week as one of its erstwhile "brain trusters" swept the field in Bob Hatfield's annual kilowatt-hour-output guessing contest.

Frank Nitzberg, of Detroit Edison's purchasing establishment and an OWU-Equipment Production Division veteran, won the 1947 contest. With typical OWU precision, he forecast an output of 255,400,000,000 kwhr. He missed by 6,000,000 kwhr, according to EW's Annual Statistical Issue, which set the 1947 output at 255,394,000,000 kwhr. His guess was wrong by a mere 0.002 of 1 percent. He plotted the history of recent years and projected it through 1947.

OWU's exercise of mortmain on the prediction of power output wasn't confined to Nitzberg, either. The three closest guesses came from its sons.

In second place came C. A. Leland, president of Iowa Power & Light Co, who guessed 255,555,000,000. That made him wrong by 161,000,000 kwhr, or 0.06 of 1 percent. Under the stress of war-time conditions, this might not have qualified him for the OWU varsity. Today, it's worth a letter-sweater in Hatfield's league.

Clarence Mayott, assistant to the president of Hartford Electric Light Co and a long-termer in OWU's Power Supply Section, placed third. He called it for 256,100,000,000 kwhr. This was off 706,000,000 kwhr, or 0.27 of 1 percent. Tied for fourth were Charles E. Kohlhepp, vice-president and general manager of Wisconsin Public Service Corp and a former OWU operator, and L. J. Cooley, superintendent of steam generation for Rochester Gas & Electric Corp. Each guessed 254,500,000,000 kwhr, and was wrong by 894,000,000 kwhr, or 0.35 of 1 percent. Obviously neither Mayott, Kohlepp, nor Cooley could even make the OWU squad, let alone the varsity.

F. NITZBERG

Hatfield, assistant general sales manager of Combustion Engineering, was an OWU and WPB official during the war. He has continued the informal output guessing contest which grew up in OWU during the war. During 1948, he anticipates, it will be expanded somewhat.

Behling Again Nominated to Fill Vacancy on FPC

President Truman sent the name of Burton N. Behling to the Senate again last week (Jan. 9) as his nominee to fill the vacancy on the Federal Power Commission. Congressional leaders conceded that chances for Behling's eventual confirmation were good but predicted that it would not be soon.

Behling, who has been completing work on FPC's natural gas investigation docket, was nominated last year to replace retiring Commissioner Richard Sachse and fill a new five-year term starting last June. His appointment was reported favorably by the Commerce Committee in the closing days of the regular Congressional session but, with several others, failed to reach a floor vote.

The Commerce Committee has scheduled no new action on the nomination and probably will not do so during the absence of the chairman, Sen. Wallace White, who is ill. Sen. E. H. Moore of Oklahoma, leader of the opposition to Behling in committee last year, indicated that he had not changed his views on the nomination.

Another FPC nomination will be in order next June with the expiration of the term of Commissioner Harrington Wimberly, a Democrat.

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UEW Going after Raises

The United Electrical Workers, CIO, will seek substantial wage increases when they begin negotiations early next month with leading electrical manufacturers. It is taking this action because of the increase in living costs. Other benefits will also be sought.

Central Power & Light Co Reveals Expansion Plans

Texas Utility Will Up Generating Capacity 83 Percent—4 New Units Will Add 90,000 Kw to System

CORPUS CHRISTI—Central Power & Light Co has underway a six-year program to increase its generating capacity by 83 percent. Transmission and distribution facilities will also be strengthened during this period, President Lon C. Hill said in a recent interview.

From 1946 to 1951, the utility will spend $43,269,000. About $14,234,000 of this total will have been spent by the end of 1947. Plant assets in 1946 were only $55,607,507.

The generation construction program will add 90,000-kw capacity to the system. The first of the four installations, a 20,000-kw unit at the La Palma Plant, San Benito, Tex., is already in operation. A second unit of the same size is now being installed and is to go into operation late in 1948. A 30,000-kw unit is to be installed at the Nueces Bay Plant at Corpus Christi by the middle of 1949. The fourth installation, a 20,000-kw unit or larger, will be made at a new plant at Laredo, Tex. This is expected to go on the line in 1951. The new units will raise system capacity from 108,599 kw to 198,699 kw.

The need for the expansion program was attributed by Hill to the growing demand for electricity in the part of Texas served by his company. The population has also grown and the electrification program of the company has increased demand still further.

Since 1939, kilowatthour sales have increased approximately 142 percent. Monthly sales averaged about 19,400,000 kwhr and 47,000,000 kwhr in 1947. In the same period, farm customers increased from 4,996 to 5,527 or 10.6 percent; residential customers from 51,277 to 93,480, or 82.4 percent; and commercial customers from 18,388 to 26,639 or 44.8 percent. Industrial customers decreased from 1,082 to 1,071 because of a reclassification of customers.

Farmers are now using 37.1 percent more electricity than in 1939, residential customers 16.5 percent more, commercial customers 89.2 percent, and industrial customers 90 percent.

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Water Properties Sold

The Kentucky Utilities Co has sold its water properties and three ice plants to the Kentucky Water Service Co for $1,150,000.

BANQUET given by the Northern States Power Co for rural electrification and agricultural leaders in Minnesota

Multiple Points of Supply Increase Profits of Co-ops

Utilities and Municipals Praised for Selling Power to 26 Minnesota Co-ops at Points Where Needed

Multiple points of supply were credited with making 26 REA cooperatives in southern Minnesota among the most profitable in the nation by Clarence H. Gelder, manager of the Dakota County Electric Cooperative. Gelder made this claim at the recent annual rural electrification banquet of the Northern States Power Co. The banquet was attended by Gov. Luther W. Youngdahl of Minnesota, state legislators, agricultural leaders, and officials of the state co-ops, municipal power systems, and the utility.

In giving the history of the successful efforts of the group of co-ops to supply not only cheap but also adequate electric service to the greatest number of farmers, Gelder gave the credit to the privately-owned utility companies and the municipal systems.

The plan that was adopted was to allow the co-ops to secure their power not from one point but from as many points of supply as were convenient. This reduced or eliminated the necessity of having long transmission lines. Often the size or number of substations were reduced.

Other advantages of the plan stressed were:

1. It provides adequate service and voltage.

2. It reduces line losses so that every time a new point of connection is established less current has to be purchased than before.

3. It makes sectionalizing possible; thereby inconveniencing a minimum number of customers and requiring less time and expense to locate and repair the trouble.

4. It is flexible in sectionalizing present lines and in adding new ones.

Gelder, using the latest REA Statistical Report as his authority, said that the 26 co-ops, representing in number less than one-fortieth of all cooperative projects in the United States, earned a surplus in 1945 amounting to more than one-twelfth of the consolidated total surplus reported by all REA systems.

Or, considered in terms of their own income, these same 26 projects realized a surplus (after all expenses, including interest and depreciation) equal to 24.2 percent of their total operating revenues for the year.

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Consumers Power Plans to Add 7 Generating Units

Consumers Power Co, Jackson, Michigan, will spend approximately $35,000,000 this year in increasing generating capacity and expanding its system. This is the largest one-year construction budget in the history of the company.

Power plant construction will take $17,829,200. Much of this money will be used for the B. C. Cobb Plant, now under construction in Muskegon. This plant is to go into operation in September with two 60,000-kw units. Another 60,000-kw unit is scheduled for late in 1949.

A 50,000-kw unit is to go into operation in March, at the John C. Weadock Plant at Essexville. Construction work will be continued, however, as a 60,000-kw unit is to be ready for service late in 1949, and a second unit of the same size, early in 1950.

Expansion of the Bryce E. Morrow Plant at Kalamazoo will begin shortly. A 60,000-kw unit is expected to be ready for operation in July, 1949.

The seven units in the three plants will increase Consumers' capacity more than 60 percent.

High-voltage transmission lines and substations to be built this year will cost $6,744,000.

Distribution-line improvements in the 51-county area served by the utility will cost $10,650,000. These lines will bring service to about 27,000 additional customers.

New York Utility Will Up Capacity to 3,000,000 Kw

Consolidated Edison Co of New York, Inc, will increase its capacity from 2,556,000 to 3,000,000 kw in the next four years. The expansion program will cost over $160,000,000, President Ralph H. Tapscott said in making the announcement.

The utility serves practically all of New York City except the Borough of Richmond and part of Queens Borough.

At the Waterside Plant, which now has a capacity of 513,089 kw, three units with a total capacity of 170,000 kw are to go into operation this year. In 1949, a 50,000-kw unit will be added.

At the East River Plant, originally a 25-cycle station, two 120,000-kw units will be added to furnish 60-cycle current. This power will be distributed by a method new to the New York area. A substation is to be built near the center of a downtown Manhattan ac network area and will receive energy from the East River Plant by means of 69-kv underground transmission cables. At the substation, this voltage will be reduced to normal distribution potentials.

A new switching station will be erected in Jamaica and another in north Queens. The Jamaica station will be connected through two 138-kv underground transmission cables to the Hudson Avenue Plant in Brooklyn and to a line connecting with the Long Island Lighting System. The Jamaica station will also be tied in with the north Queens station and the Hell Gate Plant in the Bronx by two additional 138-kv lines.

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Wage Raise Granted

Pacific Gas & Electric Co has signed an agreement with 4,500 members of the Utility Workers Union, CIO, for a one-year continuation of its present contract. An interim 5-cents-an-hour increase, effective to March 31, has been given.

SEC RULINGS

BIRMINGHAM ELECTRIC Co's proposed issue and sale of $1,000,000 principal amount of first mortgage bonds, 3⅛ percent series, due 1977, to three institutional investors at 99.517 percent of principal amount has been approved. (Release No. 7926).

GENERAL PUBLIC UTILITIES CORP has been authorized to transfer to its subsidiary, Rochester Gas & Electric Co, cash funds in an aggregate amount of $1,100,000. (Release No. 7927).

MINNESOTA POWER & LIGHT Co has been authorized to submit for preferred stockholder approval certain proposed charter amendments, including reclassification of its 2,000,000 shares of $10 par common stock. The utility is engaged in a construction program which, the company states, will require expenditures of about $12,000,000 through 1949. The charter revisions were sought to facilitate future financing of the program. About $8,000,000 of the total expenditures will be raised from proceeds of securities proposed to be issued and sold in 1948 and 1949. As a first step in this financing program, Minnesota plans to sell 100,000 shares of common shortly after adoption of proposed charter amendments. Further funds are to be provided through a $1,800,000 temporary bank loan in 1948 and through sale of $5,000,000 of bonds in 1949. (Release No. 7931).

PUBLIC SERVICE CO OF NEW HAMPSHIRE has received approval of its proposal to borrow $4,900,000 from several banks on its 2 percent promissory notes. (Release No. 7933).

NARRAGANSETT ELECTRIC Co has been authorized to borrow up to $6,500,000 from banks. The company, a subsidiary of New England Electric System, will use the proceeds to temporarily finance its construction program to the end of next May, and to retire $3,000,000 of outstanding notes. (Release No. 7939).

NEW ENGLAND GAS & ELECTRIC Co subsidiaries have received approval of their plan to borrow an aggregate of $10,398,000 from the First National Bank of Boston. The subsidiaries and the sum each proposes to borrow, chiefly for plant improvements, are: New Bedford Gas & Edison Light Co, $6,250,000; Cambridge Electric Light Co, $2,848,000; Cape and Vineyard Electric Co, $950,000 and New Hampshire Gas & Electric Co, $350,000. (Release No. 7941).

AMERICAN LIGHT & TRACTION and United Light & Railways Co, its parent, have received approval of their joint reorganization plan. The plan provides for construction of an interstate natural gas transmission pipeline at a cost estimated in excess of $104.5 million. The program also provides for an offer by American Light to retire its outstanding non-callable preferred stock at $33 a share, which the commission found "represents a fair measure of its present investment worth, and will provide fair and equitable treatment" to American Light's security holders. The plan further provides that, beginning immediately, American Light will dispose of the 1,418,125 shares of Detroit Edison Co common stock which it owns, through public sale of 1.1 million shares in three blocks and by distributing the balance to its common stockholders as dividends in lieu of cash. (Release No. 7951).

MIDDLE WEST CORP'S application for authority to sell all outstanding capital stock of the Oklahoma Power & Water Co, a subsidiary, to the Public Service Co of Oklahoma has been approved. After purchasing the securities, consisting of 23,141 shares of $100 par value common stock, for $1,700,000, plus closing adjustments, Public Service will cause Oklahoma Power to sell all of its water properties to the Sand Springs Water Co, a recently organized non-utility company, for $362,664, subject to closing adjustments. Oklahoma Power will apply the proceeds, estimated at $375,000, to reducing its outstanding bank notes. To obtain funds for purchase of the water properties, Sand Springs Water intends to sell to Middle West all of its authorized capital stock, consisting of 4,500 shares of $100 par value common stock, for $450,000. Concurrently with the sale of the water properties, Public Service will cause Oklahoma Power to distribute to Public Service, as its sole stockholder, all of its property and assets in cancellation and retirement of its capital stock and in complete liquidation of Oklahoma Power. (Release No. 7942).

OHIO PUBLIC SERVICE Co's proposal to sell $3,000,000 of installment notes, payable in 10 equal installments, to certain banks has been approved. Proceeds from sale of the notes, which will bear interest of 2½ percent annually for 5 years and 2¾ percent for the second 5 years, will be used to repay $3,000,000 of outstanding short-term notes, due next March 12. The commission has reserved jurisdiction with respect to the issue and sale of $10,000,000 principal amount of first mortgage bonds, for which the utility made application to the commission. (Release No. 7953).

PUBLIC SERVICE CORP OF NEW JERSEY has received commission approval of its reorganization plan. The plan provides for the following steps: (1) Public Service will transfer to its principal utility subsidiary, Public Service Electric & Gas Co, all its assets in exchange for PEG $18,195,600 principal amount of 6 percent debenture bonds, 6,062,767 shares of $1.40 dividend preference common stock, and 5,503,193 shares of common stock. (2) Public Service will exchange (a) the 6 percent debenture bonds, on a dollar-for-dollar basis, for all its own publicly-held 6 percent perpetual interest-bearing certificates which are outstanding in like principal amount as the debenture bonds; (b) 4.70 shares, 4.15 shares, 3.70 shares and 3.25 shares of the $1.40 dividend preference common stock for its own publicly-held 8, 7 and 6 percent and $5 cumulative preferred stocks, respectively; (c) one share of common stock of PEG and 1/10 of a share of the common stock of South Jersey Gas Co (a utility subsidiary of Public Service) for one share of the publicly-held common stock of Public Service. (3) Stock structure Public Service Coordinated Transport Co will be converted to an all-common stock basis. (4) Securities of County Gas Co (a utility subsidiary of Public Service) held by Public Service will be sold, or otherwise disposed of, by it. (5) PEG and Transport will make certain accounting adjustments to eliminate the major portion of the intangibles now carried in their plant and property accounts. (Release No. 7964).

NORTH WEST UTILITIES Co, a subsidiary of the Middle West Corp, has received commission approval of its amended dissolution plan. Under the program the holders of North West's 7 percent prior lien preferred shares, other than Middle West Utilities, will receive 11½ shares instead of 10½ shares, as originally proposed, of Wisconsin Power & Light Co common stock for each prior lien share, plus cash equivalent to a dividend at the rate of $7 from Dec 31, 1946. The approved plan also provides for distribution of 10 shares of Wisconsin Power common for each share of 7 percent preferred, other than those owned by Middle West, plus cash at the rate of $7 per annum from Dec 31, 1946. In exchange for holdings of 26,373 shares of North West 7 percent prior line preferred, 21,687 shares of 7 percent preferred, 24,000 shares of $6 preferred and 260,531 shares of common, Middle West will receive approximately 668,759 shares of common stock of Wisconsin Power. In addition, the parent will receive all cash assets of North West, which will dissolve. (Release No. 7971).

MEETINGS

National Adequate Wiring Bureau—Annual Conference, Stevens Hotel, Chicago, February 22-26. O. C. Small, secretary, 155 East 44th St., New York 17, N. Y.

American Society of Mechanical Engineers—Spring Meeting, St. Charles Hotel, New Orleans, March 1-4. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York 18, N. Y.

Oklahoma Utilities Association—Annual Convention, Biltmore Hotel, Oklahoma City, Okla., March 11-12. Miss Kate A. Niblack, secretary, 625-626 Biltmore Hotel, Oklahoma City 2, Okla.

National Electrical Manufacturers Association—Winter Convention, Edgewater Beach Hotel, Chicago, March 14-18. W. J. Donald, managing director, 155 East 44th St., New York 17, N. Y.

Midwest Power Conference—Sheraton Hotel, Chicago, April 7-9. Prof Stanton E. Winston, director, Illinois Institute of Technology, 3300 S. Federal St., Chicago 16, Ill.

Previously Listed

American Institute of Electrical Engineers—Winter General Meeting, William Penn Hotel, Pittsburgh, January 26-30.

Missouri Valley Electric Association—Power Sales Conference. President Hotel, Kansas City, Mo., February 5-6.

Edison Electric Institute—Transmission and Distribution Committee, New Jefferson Hotel, St. Louis, February 9-10; Prime Movers Committee, Edgewater Beach Hotel, Chicago, February 9-10; Meter and Service Committee, Joint Meeting with the AEIC Committee on Metering and Service Methods, Biltmore Hotel, Oklahoma City, Okla., February 9-11; Electrical Equipment Committee, Netherland Plaza Hotel, Cincinnati, February 12-13; Accident Prevention Committee, Roosevelt Hotel, Pittsburgh, February 16-17.

Pennsylvania Electric Association—Prime Movers Committee, Hotel Alexander, Hagerstown, Md., February 19-20; Electrical Equipment Committee, Castleton Hotel, New Castle, Pa., February 19-20; Systems Operation Committee, Abraham Lincoln Hotel, Reading, Pa., February 19-20; Transmission and Distribution Committee, Castleton Hotel, New Castle, Pa., February 26-27.

Europe Won't Get Heavy Equipment Needed in U. S.

Reassurance that the Marshall Plan will not siphon off heavy electrical equipment from the U. S. for some time to come was voiced this week (Jan 12) by Commerce Secretary W. Averell Harriman.

"No large generating equipment, of which we are now extremely short, is contemplated to be supplied (to Europe) until toward the end of the program," Harriman told the Senate Foreign Relations Committee.

Outlining the Commerce Department's estimate of the impact of European aid on U. S. industry, the Secretary noted that electrical equipment to the total value of $345,000,000 would be required from this country. This would include generating equipment, motors, and other electrical machinery and supplies. Of this total, $70,000,000 would go to power generating industries, with the remainder destined for use in fertilizer production, mining operations, and other industries, he said.

"Our annual production of all these items now exceeds $4 billion, and we have usually exported 6 percent of our production," Harriman asserted. "There is contemplated a relatively large increase over our regular exports to Europe in this category, but our total exports to all destinations are not expected to exceed 8 percent of production."

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Consumers Power Plans Mobile Telephone System

Consumers Power Co, Jackson, Mich., has planned what is considered to be the "largest single private mobile telephone system in the world." When completed it will have 52 stations, and 767 trucks and automobiles will be equipped to receive or transmit phone calls. The first station will be at Lansing. Installation of the system, which will take over a year, will begin in spring. Michigan Bell Telephone Co will perform all technical work and supply equipment on a rental basis.

Each vehicle is to be equipped with a loud speaker for verbal signaling from the land station near which it is operating. a telephone headset with which to carry on conversations, a radio receiving unit, and a 30-w transmitter.

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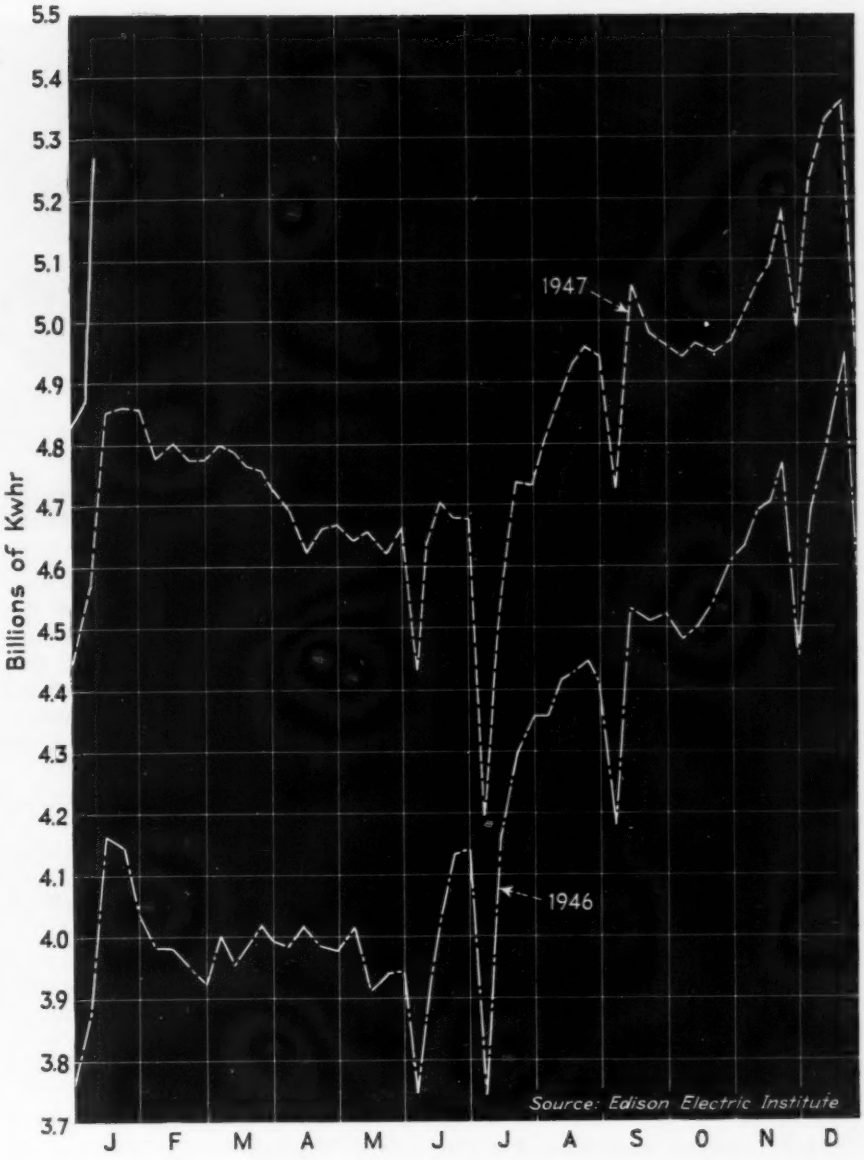
Utility Payments Increase

Alabama Power Co is now paying Gadsden, Ala., 3 percent of its gross receipts instead of 2 percent.



Output Curve Moves Sharply Upward

The electric output curve advanced sharply during the week ended Jan 10, 1948, according to figures released by the Edison Electric Institute.

Electric light and power companies distributed 5,277,680,000 kwhr of electric energy during that week, comparing with 4,868,011,000 kwhr during the preceding week, the first week of the new year. During the week ended Jan 11, 1947 the amount of electrical energy distributed totaled 4,852,513,000 kwhr, this year's figure representing an increase of 8.8 percent. The overall percent change for the preceding week was an increase of only 6.4 percent.

The largest increase reported by any geographical group was that shown by the west central states, with a 13.9 percent gain over the corresponding week of 1947. For the preceding week this group showed a gain of only 4.1 percent. The only group reporting a decrease was the Pacific Coast, 8.3 percent compared with 10.0 percent.

Weekly Output, Millions Kwhr

1948		1947		1946	
Jan. 10	5,278	Jan. 11	4,853	Jan. 12	4,163
Jan. 3	4,868	Jan. 4	4,574	Jan. 5	3,865
1947		**1946**		**1945**	
Dec. 27	4,830	Dec. 28	4,442	Dec. 29	3,759
Dec. 20	5,368	Dec. 21	4,940	Dec. 22	4,239
Dec. 13	5,327	Dec. 14	4,778	Dec. 15	4,154
Dec. 6	5,218	Dec. 7	4,673	Dec. 8	4,097
Nov. 29	4,933	Nov. 30	4,448	Dec. 1	4,043
Nov. 22	5,180	Nov. 23	4,765	Nov. 24	3,841

Percent Change from Previous Year

	Jan. 10	Jan. 3	Dec. 27
New England	+ 9.2	+ 8.5	+ 9.1
Mid-Atlantic	+ 4.9	+ 3.7	+ 8.3
Central Industrial	+10.0	+ 8.3	+ 8.9
West Central	+13.9	+ 4.1	+10.7
Southern States	+ 9.5	+ 4.0	+ 9.2
Rocky Mountain	+ 7.5	+ 7.2	+12.2
Pacific Coast	+ 8.3	+10.0	+ 6.3
Total United States	+ 8.8	+ 6.4	+ 8.7

2 New Plants in Mexico Will End Power Shortage

25,000-Kva Unit Will Be Added by Private Utility — Government Will Increase Plant 27,000 Kva

(McGraw-Hill World News)

MEXICO CITY—Installation of additional new generating equipment at two important plants in and around the Federal District, Mexico's equivalent of our District of Columbia, will go far toward solution of Mexico City's power shortage.

The installations will be at the Mexican Light & Power Co's plant at Nonoalco and at the government-operated plant at Ixtapantongo.

Nonoalco, located on the outskirts of the capital, is a steam-electric plant of 55,000 kva. ML&P plans to raise its capacity to 80,000 kva.

Ixtapantongo which now develops 30,000 kva will be raised to 57,000 kva. Power developed at Ixtapantongo is distributed through ML&P and its subsidiaries to ML&P consumers.

In addition, ML&P has longer-range plans for increasing its capacity. These include six Diesel-powered generators at its Tacubaya substation in the capital, and construction of another hydroelectric plant on the Gulf slope at Patla, below the company's main generating plant at Necaxa. The combination of the Diesel units and the new hydroelectric station would boost the company's capacity about 50 percent.

Expansion Plans of Long Standing

ML&P sources emphasize that the company's expansion plans were "on the books" long before last summer's drought and the sharpening of public interest in the power situation that came with a government-enforced 40 percent reduction in consumption.

With criticism for an alleged "do-nothing" attitude, which brought union and press demands for power nationalization, ML&P was moved to explain the situation and how it proposed to avoid its recurrence.

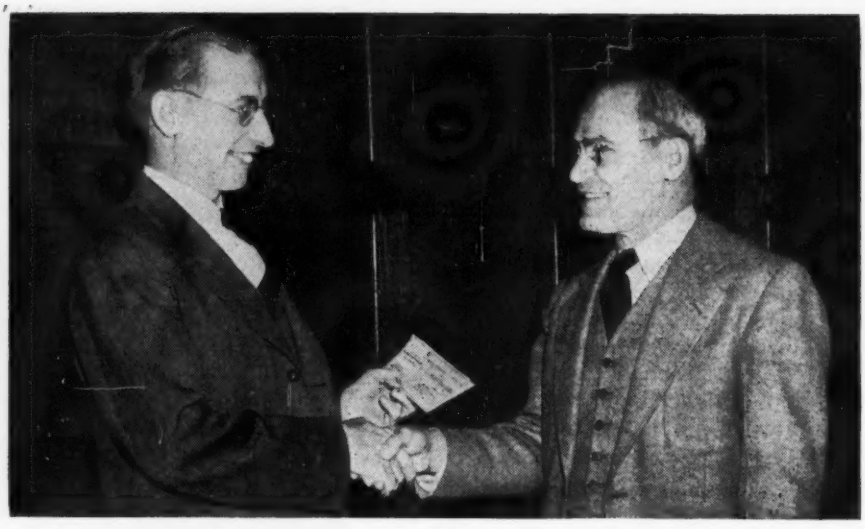
Delivery of the six units for Tacubaya, on order in the United States, is expected to start shortly. The six, when installed will increase ML&P's production by about 30,000 kva.

The new equipment at Nonoalco is expected to go into service at any time while the installation at Ixtapantongo should be completed by this spring. The proposed Patla plant, according to the union, will have a capacity double that of Necaxa, heretofore, the main ML&P power source. Necaxa has a capacity of about 100,000 kva.

One company source, emphasizing the Patla installation has long been "planned," said it probably will be completed within the next "four or five years."

Meanwhile, ML&P can count on the hydroelectric plant at Necaxa, the steam generating plant at Nonoalco and the diesel units at Tacubaya, as well as the government plant at Ixtapantongo as its main sources of power.

The federal government, too, has ordered diesel-generating equipment for installation in various locations outside the Federal District and the area now served by ML&P. Delivery of the units is not expected for sometime, however, but upon their arrival the equipment will be employed in the government's national electrification program.



FOR SUGGESTING the name, "Pole-Star," for a new distribution transformer made by the Pennsylvania Transformer Co, E. A. Cunningham, left, squad leader in the electrical design section of Pennsylvania Power & Light Co, receives the congratulations of Samuel Horelick, president of the transformer company. The Allentown man was given $500. George O. Elmore, engineer of the Southern California Edison Co, took second and $250 for "Mastercore." R. H. Hill, industrial manager, Pennsylvania Electric Co, with "Monolap," and C. V. West, superintendent of meter installations, Virginia Electric & Power Co, with "Mono-lap," tied for third. Each received $100

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Use of Arsenals to Make Electric Equipment Urged

It's still just a gleam in the eyes of some former New Deal planners, but the Army and Navy are considering a proposal that their arsenals produce electric generating equipment.

Idea is that skilled machinists in government arsenals, who are no longer busy with military projects, could produce generator and turbine components. Their output, it is held, would augment the production of equipment manufacturers, speeding up deliveries of complete units.

The proposal has been submitted to Defense Secretary Forrestal by Dewey Anderson, director of the Public Affairs Institute. Anderson, former Chief of Staff of the Senate Small Business Committee and earlier a TNEC adviser, suggests it as a means of breaking the bottleneck in heavy electric equipment supply.

Associated with Anderson's research organization and presumably also interested in the arsenal plan, is Stephen Raushenbush, former staff member of the Interior Department's division of power.

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Dr Karapetoff Dies

Dr. Vladimir Karapetoff, emeritus professor of electrical engineering at Cornell University, died in New York on Jan. 11 of a heart condition. He was 72 years old. His forte was the application of mathematics to engineering problems. Dr Karapetoff had been blind since 1943 but continued his activities as an engineering consultant, lecturer and pianist.

Other News

New Equipment . . . . Page	204
News About People	219
Manufacturers & Markets .	232
Construction	235

Electrical World

OPINION

Where It's Coming From

IN THIS ISSUE of ELECTRICAL WORLD, the electric utility industry's annual budget for capital expenditures in 1948 is estimated at slightly more than $2,000,000,000. Of this amount about 15 percent will be spent by municipals and other local publicly-owned utilities. That leaves about $1,700,000,000 as the power company construction budget for next year.

Weighted averages of the replies to ELECTRICAL WORLD's survey indicate the source of this $1,700,000,000 the private electric utilities plan to spend. They show:

35 percent, $595,000,000, from internal sources.
12 percent, $204,000,000, from bank loans.
41 percent, $697,000,000, from sale of bonds.
5.5 percent, $93,500,000, from preferred stocks.
6.5 percent, $110,500,000, from common stocks.

Students of today's financial picture will welcome these figures, we feel sure, even though they are only estimates on estimates. Only the first appears reasonably foolproof. The remainder are open to question. It will be interesting to watch the markets to see how the security sales progress.

GE Cuts Prices

GENERAL ELECTRIC COMPANY'S price reduction plan, now almost three weeks old, hasn't drawn much action from other manufacturers. But it did provoke last week's sneer by the United Electrical Workers—CIO. UE made it plain that its "third round" wage drive on GE is not to be affected by any such move. Publicly, at least, the union isn't concerned about the position it might occupy if or when it slugs a wage boost out of a company which has voluntarily cut prices.

But UE is thinking about this problem, anyway. In its announcement, UE mumbled something about GE's recent "increase" in heavy power equipment prices. That "increase," it will be remembered, was a departure from a firm price policy for costly equipment now booked for delivery as much as four years in advance. GE forsook that policy for one in which prices on such long-lead-time equipment may vary 20 percent up AND down.

Such a plan, of course, conforms much more closely to UE tactics than a firm price policy ever did. We have never seen that union sign a contract stipulating its wage rates four years in advance, nor do we ever expect to. So we may be pardoned a snicker as UE attacks GE for a move which it wouldn't even consider for itself.

One other point seems worth noting. "We hope," said the GE announcement, "that this will not be misconstrued as an attempt on the part of GE to reduce profits. As we have pointed out repeatedly in recent months, our profit, running at the rate of 6.8 cents on the sales dollar, is less than half the pre-war rate and much lower than the normal safe rate which we believe is necessary in the operation of our business."

It's heartening to find a business leader taking such a position, particularly when profits are being attacked on all sides. UE, being a nonproductive outfit, can live only so long as those concerns with whom it deals make a safe profit. Do we hear UE halting its attack?

It Works Both Ways

FOR YEARS, Maine has refused to export its hydroelectric power. Its point was clear. Hydro power was a Maine resource and should be devoted to the delevolpment of Maine, not other New England states. It is not an uncommon philosophy, and parallels that which has motivated certain Southern states exporting natural gas.

This fall, Maine drew power from a Navy vessel anchored at Portland and operating its generating equipment to help overcome the effects of a severe water shortage. Whether it would have been necessary to use such makeshifts if Maine were interconnected with its neighbors is problematical. The rest of New England is faced with a water shortage, also. It might not have had the energy to export if it had the means of transmitting it.

But it remains true that Maine's refusal to interchange its hydro energy with other parts of New England has deprived it of transmission lines which might be of great help to Maine on such occasions as this. It's a two-edged sword Maine has forged.

. . . Where We Came In

THE FIRST CONFERENCES aimed at setting up voluntary allocation programs for five industries—including heavy power equipment—have been held in Washington. More will be held. The aim: To insure that materials and components of our most vital industrial equipment shall be available when and where needed.

To the power business this has a familiar ring. This is where we came in. Remember? It was seven or so years ago. The war was on. We were in it, a fact which some didn't know and the remainder hadn't admitted. There was the National Defense Advisory Committee.

There was the hydra-headed OPM. There was SPAB. Finally we got WPB, whose initials persisted even if its basic operating practices were to undergo violent changes —priorities, directives, PRP and CMP.

So here we go again. Admittedly, there is a world of difference between VP-1, VP-2, etc, (today's alphabet soup) and WPB as it was known from 1943 through the end of the war. Still, today's VP programs are headed down the same road as that travelled by WPB in its evolution. It's tortuous, but the signs are plentiful. They are lettered most clearly—Controls, Controls, Controls. Seven years ago, there was only a tiny political element in the control pattern—and it was washed out entirely as WPB evolved. Who can honestly anticipate the same today?

Seven years and less ago, the great drive was for controls which would work—surely, swiftly, inexorably. Today, instead of a great drive, we have a timid backing into the problem. We wonder if this very timidity isn't the most striking proof that the controls devised are basically valueless.

At any rate, thanks to past experience, we do know effective controls. These had better be good.

Misstate of the Union

PRESIDENT TRUMAN has suggested that industry underwrite a $3.2 billion tax cut for individuals. Coming, as it does, in an election year, the suggestion has a certain amount of genius. The trouble is, its genius lies in its inconsistencies.

Just before asking it to underwrite a $3.2 billion personal tax cut, Mr. Truman urged industry to put $50 billion of new capital into expansion "within the next few years." All the evidence today shows that to raise so much money would be difficult and costly. So $3.2 billion per year which would help in the expansion job is to be taxed away for personal income tax cuts.

Electric utilities already are well on the way to meeting the President's expansion program. They stand, now, to spend up to 20 percent of the $50 billion he wants invested. Yet they turn up as whipping boys, guilty of imposing "ceilings" on industrial and agricultural output by power shortages.

The brave new world which the President envisioned was to be an achievement of free private enterprise. So he advocates more competition with free private enterprise—in power, in housing, in medicine. Inflation is strangling us. His answer: More inflationary government spending.

It is wonderful to watch the present administration weaving its way through the post-war economic jungle. Assiduously, it has resisted any cut in government spending. Indeed, the proposed budget for the oncoming fiscal year is more than $2 billion above that which was so widely attacked a year ago. The time may come when even Mr. Truman will run out of such Alice-in-Wonderland economics. Little man, what then?

WASHINGTON COMMENT

W. B. WHICHARD

POLITICS BEING POLITICS—and this an election year —it is impractical to hold any candidate responsible for his every public utterance. Even the President, who certainly will head his party's ticket next November, is expected to indulge, meanwhile, in some political double-talk. But neither as President nor as candidate can Harry Truman hope to escape challenge of inconsistencies such as those which marked his State of the Union message.

Spectacular as it was, the President's suggestion of tax relief for individuals at the expense of corporate profits simply is out of pitch with other proposals in the same speech.

"We must stop the spiral of inflation," the President asserted at one point. His plan to give $3.2 billion of tax money back to consumers of dangerously-inflated basic commodities is no step in that direction. And making up the revenue thus lost by upping corporation taxes won't help, either. Heavy industry isn't buying meat, butter and other food items with its profits.

Even less logical, in the light of his tax-cut plan, is the assertion that industry should invest "at least $50 billion" in new production facilities. Will industry, if faced with the loss of $3.2 of its profits, be either willing or able to undertake such expansion?

These conflicting statements—and there are others—cannot be attributed merely to political expediency. It seems likely that too many cooks had a hand in brewing the State of the Union broth, and that no one tasted the flavor of its logic before it was served to Congress.

The "seasoning" added by many of these "cooks" was clearly discernible. For example, the President's flat assertion that "power shortages" were imposing "ceilings" on agricultural and industrial growth was couched in language identical to that used a few weeks earlier by REA Administrator Claude Wickard. Again, the Truman plea that "public power must not be monopolized for private gain" had a familiar ring to those who heard the Interior Department's testimony on the Dondero bill last summer.

As yet, the Presidential adviser who came up with the $40-tax credit plan has remained anonymous. And well he might, since there is more than a slight chance that the proposal will develop into a political boomerang which will return to the White House door with a thud.

In proclaiming a need for tax relief this year, the President gave Republicans in Congress a new and potent talking point for their own tax reduction program. They will hammer away at this assertion by the President in an effort to gain Democratic votes needed to pass their bill over an expected veto. As it becomes clear that no other tax measure has a prayer for enactment, Democrats in Congress are likely to succumb to such pressure.

Statistics
Of the Electrical Industry

HIGHLIGHTS OF A RECORD YEAR

OUTPUT: 255,394,000,000 kwhr

In quantity, the 32,000,000,000-kwhr increase of 1947 over 1946 is the largest in the history of the industry. Practically all of the burden of this increase was carried by steam power plants. They accounted for nearly 70 percent of total output.

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CAPACITY: 51,647,000 kw

Up 1,330,000 kw over 1946; over 87 percent of the increase in power company plants and 99 percent of it in fuel power.

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NEW CAPACITY: 2,176,749 kw

About two thirds of new capacity installed in 1947 appears as net increase to total. And about two thirds of new capacity planned for 1947 was actually installed. Over 82 percent of 1947 new capacity was fuel power. Plans for 1948 are for 4,409,044 kw to be added and for 1949 and later, the figure is 18,652,000 kw.

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ENERGY SALES: 215,825,000,000 kwhr

Increase over 1946 is about 11.6 percent. Major element in increase is reversal of trend of sales to industrial users which had declined in 1946 from 1945, but turned up sharply in 1947. Rise in volume of sales to rural, residential and commercial customers faster than in preceding years.

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REVENUE: $3,800,000,000

About 9 percent increase over previous year. Over-all unit revenue declined to 1.76 cents from 1.81 cents in 1946. Residential service revenue per kwhr dropped from 3.22 to 3.06 cents, while average consumption rose from 1,329 to 1,435 kwhr.

CUSTOMERS: 38,700,000

Addition of new customers practically same as in 1946, over 2,000,000. Largest percentage gain was again in rural classification. Residential customers now number 31,550,000.

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FINANCIAL: $1,547,375,000

During the year, the utilities raised $537,729,000 of new capital, about a third of their total financing. Common and preferred stock financing amounting to $384,699,000 largely accounted for by distribution of holding company ownings. Refunding was about 10 percent more than in 1946.

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BUDGET: $2,026,653,000

Construction expenditures for 1948 estimated at nearly 50 percent more than in 1947. Largest share, about 48 percent, is for generating plant, with distribution taking 34 percent.

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MANUFACTURING:
Appliance Production Boomed

Index of production in electrical manufacturing rose far above the average of general industry, from 258 in 1946 to 384 in 1947, as against the general rise from 210 to 238. Appliances led the way to higher production levels.

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REA: 3,332,000,000 kwhr in Sales

Consumers on cooperative lines now using an average of 1,794 kwhr per year, for which they paid $61.18, or an average of 3.41 cents per kwhr. 594,000 miles of line in operation, serving 2,030,000 consumers, an average of 3.4 per mile.

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TREND

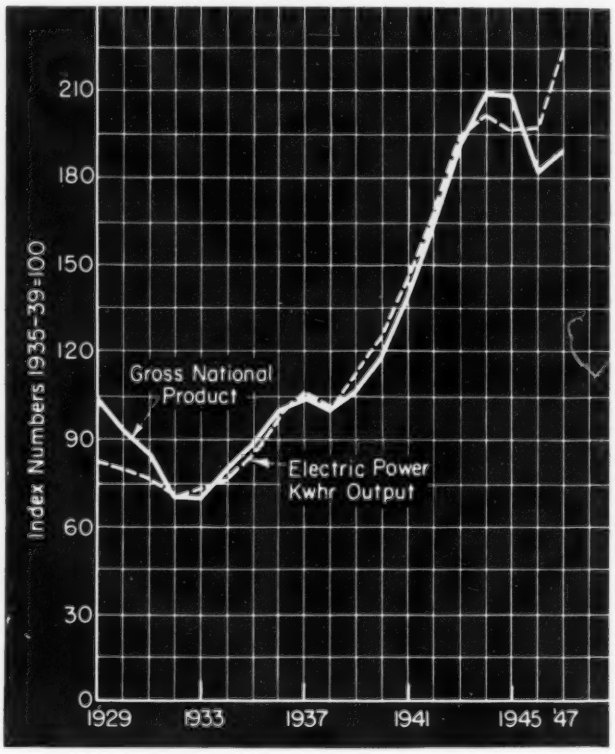
Gross national product and electricity output

IN 1947 SUPPLIERS of electricity faced a full and unfettered demand for power by a peacetime economy running in high gear. Industrial production was at a peak; consumer incomes were at an all-time high; and the output of new electrical equipment for home, farm, and factory was as great as the nation's resources would permit. The result was a record-smashing output of 255 billion kwhr. Probably the 1947 output would have been even greater if more comfortable margins of reserve capacity had permitted the utilities to resume prewar sales activities. As it was they had their hands full taking care of an unassisted load growth.

The relationship between the country's economic well being and the growth of electric power is pictured in the accompanying chart. There it may be seen that the gross national product (the value of all goods and services produced) was expanded about 4% in 1947. At the same time, the use of electricity increased some 14%. Thus, the trend toward a greater consumption of electricity in relation to the nation's total product has been resumed. During the war, of course, this trend was interrupted.

The record pace at which industry operated during the year accounted for 56% of the increased use of electricity. The Federal Reserve Index of industrial production averaged 186 for the year, as contrasted with 170 in 1946, when work stoppages dragged activity far below its peak. But as 1947 advanced, it became clear that industrial production, as well as industrial use of electricity, would grow at a slower rate in the future. Happily, assurance that such growth would continue was already at hand. For manufacturers in almost all lines were in the midst of the greatest expansion of new machinery in their history. And almost all of this equipment was to be powered by electricity.

The swift rise in electricity consumption by residential, farm, and commercial customers in 1947 was in many respects more spectacular than the



advance of industry. More new residences were completed than at any time since the mid-twenties. And although commercial building was somewhat less than in 1946, the volume remained very large. Moreover, the quantity of new electric appliances turned out exceeded even the record year of 1941. Finally, the drive to bring electricity to the farm was carried forward with great energy. All these developments added up to the healthy gains reviewed in some detail in subsequent pages.

As 1948 begins to unfold, electric power companies find their biggest concern may well continue to be their ability to meet all demands. Although some 2.2 million kw of new capacity was introduced in 1947—and a further 4.4 million is scheduled for 1948—the bright prospects for further growth in the use of electricity promise to tax this and still more new capacity.

OUTSTANDING FACTS

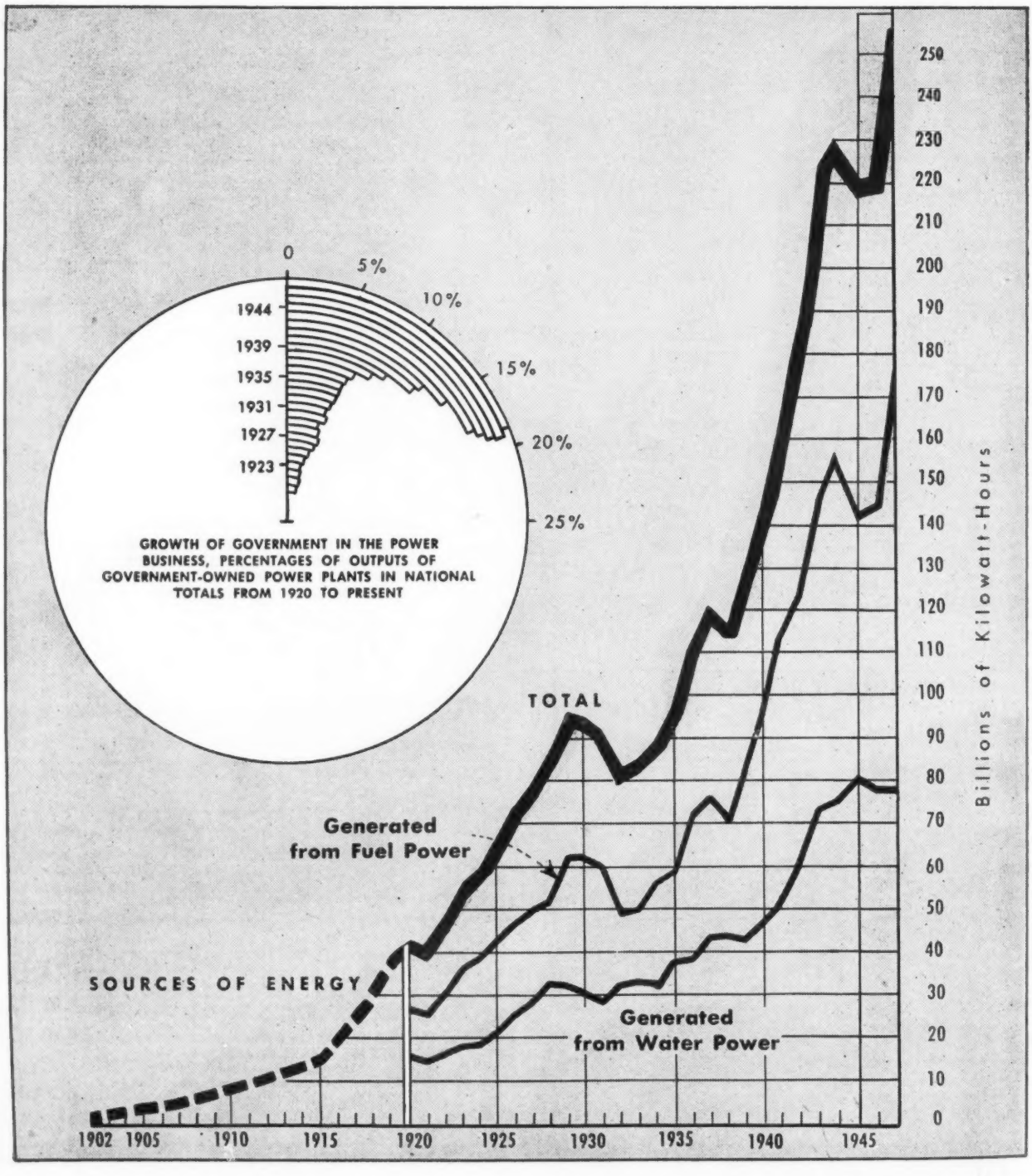
A summary statement

	1940	1941	1942	1943	1944	1945	1946	1947*
FIXED CAPITAL [1] ($1,000,000)	12,658	12,964	13,082	13,143	13,050	13,058	13,200	14,000
Securities issued [1] ($1,000)	989,459	740,832	356,254	371,062	1,018,228	1,361,922	1,082,447	1,547,375
New capital	92,376	97,065	92,666	9,920	15,587	39,699	172,846	537,729
Refunding	897,083	643,767	263,588	361,141	1,002,641	1,322,253	909,601	1,009,646
REVENUE ($1,000)								
From ult. consumers	2,440,218	2,665,057	2,885,843	3,077,643	3,276,751	3,341,518	3,459,560	3,800,000
Rural	49,473	64,396	75,027	76,617	82,842	90,344	104,786	126,000
Residential	895,951	938,229	990,185	1,029,260	1,097,726	1,167,356	1,240,577	1,346,000
Small light and power	689,253	725,117	767,279	776,228	817,356	850,213	924,775	1,020,000
Large power and light	631,428	758,083	828,318	961,642	1,043,392	1,001,957	969,348	1,085,000
Other consumers	173,752	179,233	195,034	233,996	235,436	231,648	220,074	223,000
EXPENDITURES ($1,000)								
Capital [3]	596,580	654,148	522,200	305,904	340,284	408,929	1,372,145	2,026,653
PRIVATE COMPANIES ($1,000)								
Opening revenue	2,277,000	2,475,000	2,611,000	2,807,000	2,955,000	3,012,000	3,127,000	3,465,000
Operating expenses	863,000	950,000	1,011,000	1,117,000	1,225,000	1,264,000	1,385,000	1,711,000
Taxes	404,000	521,000	630,000	688,000	677,000	662,000	639,000	655,000
Salaries and wages	355,000	376,000	381,000	371,000	388,000	452,000	603,000	710,000
OUTPUT (1,000,000 kw.-hr.)								
Generated	144,985	168,170	189,181	220,728	230,645	222,486	223,178	255,394
From steam	95,675	115,276	123,356	145,045	154,828	140,435	142,240	174,311
From water power	47,753	51,262	64,179	73,922	14,021	79,970	78,406	78,183
From internal combustion	1,557	1,632	1,646	1,761	1,800	2,080	2,352	2,880
CAPACITY (1,000 kw.)								
Generating ratings	41,639	44,092	46,407	49,305	50,278	50,111	50,317	51,647
Steam	29,019	30,823	32,332	34,178	34,609	34,112	34,318	35,593
Hydro	11,675	12,264	13,025	14,067	14,604	14,912	14,849	14,862
Internal combustion	945	1,005	1,049	1,060	1,064	1,087	1,150	1,192
FUEL CONSUMPTION								
Coal (1,000 short tons)	51,470	62,670	66,260	77,300	80,080	74,720	72,200	86,560
Oil (1,000 bbl.)	16,330	20,080	15,240	17,990	20,860	20,230	36,320	46,870
Gas (billion cu. ft.)	180	202	235	302	359	326	307	358
ENERGY SALES (1,000,000 kw.-hr.)								
Ult. consumers	118,643	140,060	159,408	185,889	198,161	193,558	190,794	215,825
Rural [4]	1,991	2,352	2,890	2,996	3,373	3,668	4,431	5,625
Residential	23,318	25,124	26,937	28,621	31,266	34,184	38,571	44,000
Small light and power	22,373	24,628	27,234	29,071	29,837	30,438	33,016	38,225
Large power and light	59,557	76,060	88,378	105,778	115,187	107,490	98,885	112,100
Other	11,405	11,896	13,968	19,423	18,498	17,778	15,891	15,875
CUSTOMERS (1,000)								
Total number	30,191	31,607	32,210	32,396	33,048	34,031	36,140	38,370
Rural [4]	686	987	1,096	1,088	1,144	1,234	1,381	1,520
Residential	24,952	26,025	26,620	26,872	27,371	28,117	29,769	31,550
Small light and power	4,260	4,300	4,219	4,168	4,263	4,398	4,693	4,880
Large power and light	178	173	150	147	153	162	175	186
Other	115	122	125	121	118	120	122	234
People in homes served (1,000)	97,424	102,695	104,882	105,000	107,000	110,000	115,000	122,000
Per cent of total civil population	74.0	78.0	77.4	77.3	80.0	81	82	85
EMPLOYEES, total	250,000	256,000	221,000	205,000	200,000	222,000	252,000	269,000

* Estimated, generally on ten months' operations. [1] Power Companies only. [2] Includes warrants and rights. [3] Excludes Federal Projects. [4] On specific rural rates only.

OUTPUT

255,394,000,000 Kwh


0
5%
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20%
25%
1944
1939
1935
1931
1927
1923
GROWTH OF GOVERNMENT IN THE POWER BUSINESS, PERCENTAGES OF OUTPUTS OF GOVERNMENT-OWNED POWER PLANTS IN NATIONAL TOTALS FROM 1920 TO PRESENT
TOTAL
Generated from Fuel Power
Generated from Water Power
SOURCES OF ENERGY
1902 1905 1910 1915 1920 1925 1930 1935 1940 1945
250 240 230 220 210 200 190 180 170 160 150 140 130 120 110 100 90 80 70 60 50 40 30 20 10 0
Billions of Kilowatt-Hours

SOURCE AND DISPOSAL OF ENERGY

(In Millions of Kw.-Hr.)

Year	Generated from		Total Generation	Add Imports from Canada	Less Energy Used by Producer	Total for Distribution	Losses	Sales to Ultimate Consumers
	Fuel Power	Water Power						
1933	50,678	34,058	84,736	613	4,910	80,439	14,523	65,916
1934	57,093	33,713	90,806	893	5,499	86,200	15,118	71,082
1935	59,430	39,034	98,464	901	5,669	93,696	16,100	77,596
1936	72,665	39,516	112,181	1,054	5,826	107,409	17,365	90,044
1937	77,348	44,489	121,837	1,733	6,428	117,142	17,783	99,359
1938	71,847	44,834	116,681	1,867	6,990	111,558	17,826	93,731
1939	86,314	44,022	130,336	1,900	7,734	124,502	18,735	105,768
1940	97,232	47,753	144,985	937	7,268	138,654	20,011	118,643
1941	116,908	51,262	168,170	927	6,335	162,762	22,702	140,060
1942	125,002	64,179	189,181	1,448	6,611	184,018	24,611	159,407
1943	147,027	73,943	220,970	1,537	9,729	211,124	25,235	185,889
1944	156,704	74,032	230,736	1,597	6,541	225,792	27,631	198,161
1945	142,516	79,970	222,486	1,773	3,368	220,891	27,333	193,558
1946	144,772	78,406	223,178	1,666	4,576	220,268	29,473	190,794
1947*	177,211	78,183	255,394	1,350	7,919	248,825	33,000	215,825

Sources: Federal Power Commission and Edison Electric Institute. * Estimated on revised basis which excludes former Mining and Manufacturing and Railroad and Railway classifications.

PRODUCTION OF ELECTRIC ENERGY BY OWNERSHIP

(In Millions of Kw.-Hr.)

Year	Privately Owned	Government-Owned		
	Electric Utilities	Local†	Federal	Total Government
1933	76,668	4,614	458	5,072
1934	82,079	4,822	357	5,179
1935	89,330	5,403	555	5,958
1936	102,293	5,951	1,072	7,023
1937	110,464	6,606	1,843	8,449
1938	104,090	6,693	3,029	9,722
1939	115,078	7,088	5,476	12,564
1940	125,411	7,842‡	8,584	16,426
1941	144,290	9,705	10,794	20,498
1942	158,052	11,034	16,893	27,928
1943	180,247	13,027	24,484	37,511
1944	185,850	13,473	28,866	42,339
1945	180,926	13,559	28,001	41,560
1946	181,020	15,198	26,960	42,158
1947*	207,768	17,791	29,835	47,626

Source: Federal Power Commission.
* Estimated. † Includes cooperatives, power districts and state projects. ‡ 1940 and following data revised to exclude production by publicly owned transit systems.

KILOWATT HOURS sent out each week in 1947 topped anything ever experienced by from 8 to 20 percent. Early months reflected the higher figure and the latter six months a consistent increase averaging better than 10 percent. The five-billion level was passed early in November. Except for sharp recessions (and equally sharp resumptions) at the several holidays the curve has been steadily upward since mid-1946.

More evident from the annual totals in the accompanying tables is the fact that total energy output in 1947 outdistanced both 1945 and 1946 by practically 10 percent and the pre-war 1941 by a good 51 percent.

Practically seven of every ten kilowatt hours were produced in fuel-burning plants. The nearest approach on the thermic-plant side was the 69 percent of 1941.

There was no significant change during 1947 in the proportions of energy from private and governmental systems; privately owned, 81.2 percent, federal projects, 11.8 percent, local-government utilities, 7 percent.

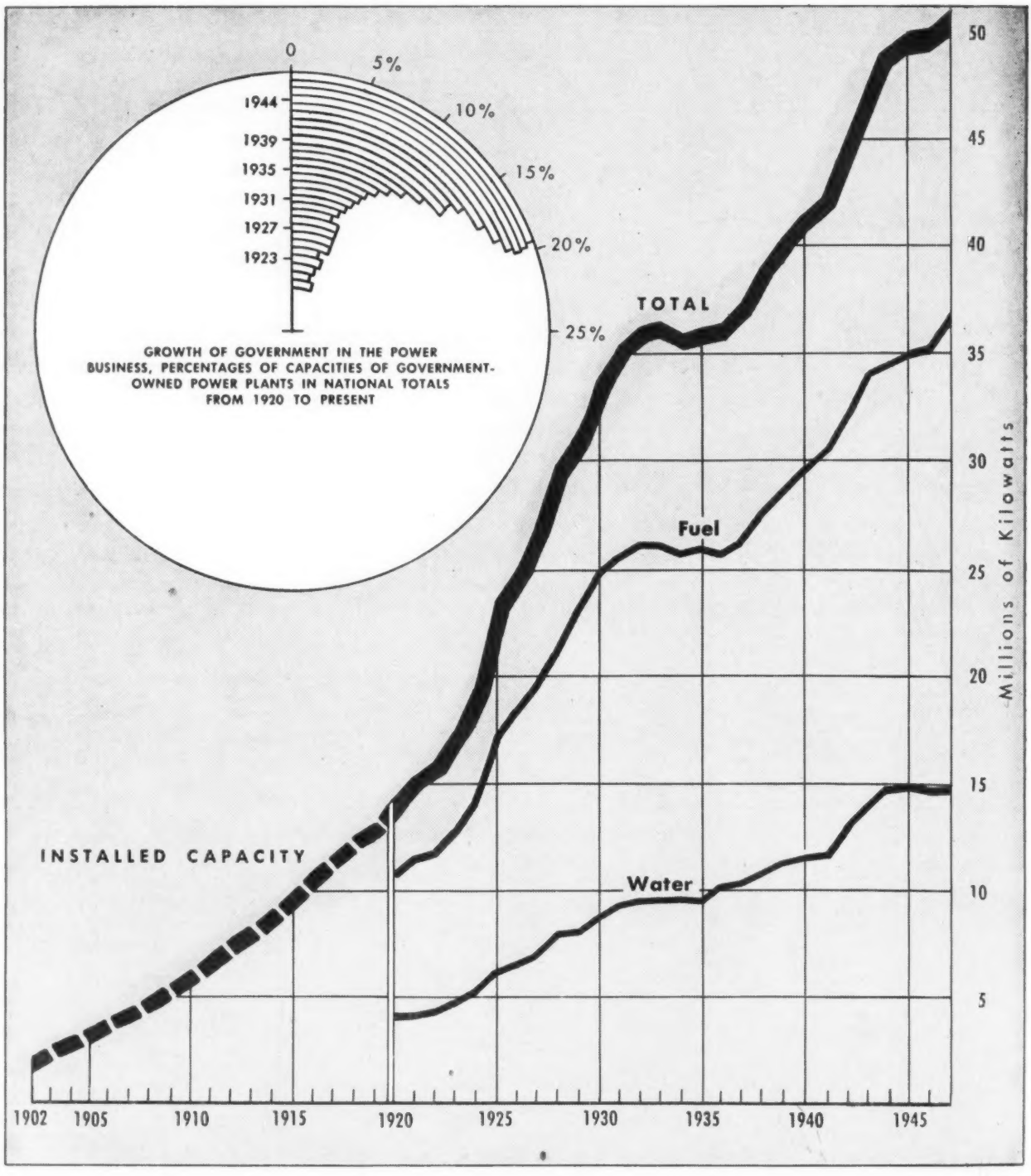
ENERGY PRODUCTION BY REGIONS

(In Millions of Kw.Hr.)

REGION	1944			1945			1946			1947*		
	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel
New England	11,988	3,116	8,872	11,805	4,087	7,718	12,307	3,667	8,640	13,389	3,754	9,815
Middle Atlantic	48,196	8,630	39,566	46,678	10,522	36,156	47,349	9,382	37,967	53,127	9,446	43,681
East North Central	53,682	3,002	50,678	50,921	3,339	47,582	50,069	3,092	46,977	58,683	3,165	55,518
West North Central	12,079	2,782	9,297	12,728	3,025	9,703	13,187	2,857	10,330	15,036	2,794	12,242
South Atlantic	27,948	7,237	20,711	28,285	8,147	20,137	28,551	9,010	19,541	32,331	8,070	24,261
East South Central	16,161	10,931	5,230	16,596	12,356	4,240	16,486	13,718	2,768	18,430	12,287	6,143
West South Central	14,154	1,053	13,102	13,682	1,428	11,255	13,069	1,448	11,621	15,553	1,191	14,362
Mountain	12,995	11,401	1,594	11,974	10,351	1,622	11,659	9,725	1,934	12,756	10,198	2,558
Pacific	30,985	25,793	5,192	29,818	26,715	3,103	30,501	25,506	4,995	36,089	27,458	8,631
United States	228,188	73,945	154,242	222,486	79,970	142,516	223,178	78,406	144,772	255,394	78,183	177,211

Source: Federal Power Commission. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. * Estimated.

CAPACITY... 51,647,107 Kw



GENERATING CAPACITY BY REGIONS

(In Thousands of Kw.)

REGION	1944			1945			1946			1947*		
	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel	Total	Hydro	Fuel
New England	3,189	894	2,295	3,198	895	2,302	3,188	892	2,295	3,283	892	2,391
Middle Atlantic	10,395	1,593	8,802	10,509	1,591	8,919	10,538	1,591	8,947	10,730	1,585	9,145
East North Central	11,317	741	10,577	11,506	739	10,768	11,575	738	10,837	11,994	740	11,254
West North Central	3,461	562	2,899	3,466	562	2,904	3,519	562	2,957	3,604	562	3,042
South Atlantic	6,258	2,086	4,172	6,557	2,222	4,335	6,629	2,221	4,407	6,696	2,221	4,476
East South Central	3,173	2,022	1,151	3,434	2,221	1,213	3,425	2,221	1,203	3,560	2,221	1,338
West South Central	2,648	371	2,277	2,694	371	2,323	2,733	385	2,348	2,996	385	2,611
Mountain	2,627	2,003	625	2,647	2,002	644	2,678	2,004	674	2,707	2,021	686
Pacific	6,120	4,314	1,806	6,100	4,309	1,791	6,030	4,233	1,797	6,075	4,233	1,842
United States	49,188	14,586	34,604	50,111	14,912	35,199	50,317	14,848	35,468	51,647	14,862	36,785

Source: Federal Power Commission. All data revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad and Railway classifications. * Data to November 1.

WHY there has been threat of a power stringency is readily seen from a comparison of the figures for growth in capacity and growth in output during 1947. The year's output grew 10 percent but the gain in capacity was only 2.5 percent. The effort to build plants and generating additions has only begun to show; unless all signs fail it will need to accelerate greatly in 1948.

All but 13,000 kilowatts of the gain was in fuel-burning plants—the increment in them amounted to 1,317,000 kilowatts. The only previous year in which any such increase was installed was 1943 with its 1,850,000 kilowatts. The 1947 gain in fuel power capacity was 5 times that of 1946.

At present the fuel-generation capacity is 71.1 percent of the total, hydro having slipped back from the 29.5 percent of 1946 to a current fraction of 28.9 percent. As to ownership, the private ownership category embraces 80.3 percent. In 1947, however, the private utilities 80.3 percent share generated 81.2 percent of the output and the governmental 19.7 percent share only 18.8 percent of the output. It was not a notable year for hydro capacity additions nor for generation by water power.

GENERATING CAPACITY BY OWNERSHIP

(In Thousands of Kw.)

Year	Privately Owned	Government Owned		
	Electric Utilities	Local †	Federal	Total Government
1933	32,163	2,191	231	2,424
1934	31,547	2,284	288	2,571
1935	31,820	2,316	300	2,615
1936	31,787	2,491	804	3,295
1937	31,958	2,829	833	3,662
1938	33,246	3,090	1,156	4,246
1939	33,908	3,304	1,650	4,955
1940	34,399	3,584‡	1,944	5,528
1941	36,041	3,933	2,371	6,364
1942	37,422	4,395	3,216	7,611
1943	39,128	4,501	4,322	8,823
1944	39,733	4,570	4,886	9,456
1945	40,307	4,723	5,081	9,804
1946	40,355	5,062	4,920	9,982
1947*	41,507	5,221	4,919	10,140

Source: Federal Power Commission. * Data to November 1. † Include cooperatives, power districts and state projects. ‡ 1940 and following figures revised to exclude publicly owned transit capacity.

INSTALLED CAPACITY

(In Thousands of Kw.)

Year	Type of Prime Mover		
	Fuel	Water	Total
1933	26,507	9,736	36,243
1934	26,049	9,742	35,791
1935	26,279	9,795	36,074
1936	26,128	10,436	36,564
1937	26,558	10,577	37,135
1938	27,976	11,066	39,042
1939	28,903	11,415	40,318
1940	29,964	11,675	41,639
1941†	30,588	11,817	42,405
1942	32,211	12,842	45,053
1943	34,067	13,884	47,951
1944	34,603	14,586	49,189
1945	35,199	14,912	50,111
1946	35,468	14,849	50,317
1947*	36,785	14,862	51,647

Source: Federal Power Commission. * Data to November 1. † 1941 and following revised to correspond with current basis which excludes former Mining and Manufacturing and Railroad classifications.

NEW CAPACITY...23,061,065 KW

PROJECTED ADDITIONS to generating capacity for public supply of electricity from the end of 1947 through 1952 amount to 23,061,065 kw. In 1947, 2,176,749 kw were installed. The total of these is 25,237,814 kw. These figures were compiled from Electrical World's annual survey of utility construction.

Checking this total is another. As of December 1, 1947, manufacturers had on order some 17,900,000 kw. In 1947, they delivered about 2,800,000 kw. The total of these is 20,700,000 kw.

The difference between the two totals is undoubtedly caused by the fact that part of the projected new capacity has not yet been ordered. Either of the totals may be accepted as a measure of electricity supply expansion in the next few years. Each indicates a 5-year rate of immediate future growth considerably greater than was contemplated a year ago. Instead of 30 percent, as was then expected, the expansion may be as much as 50 percent.

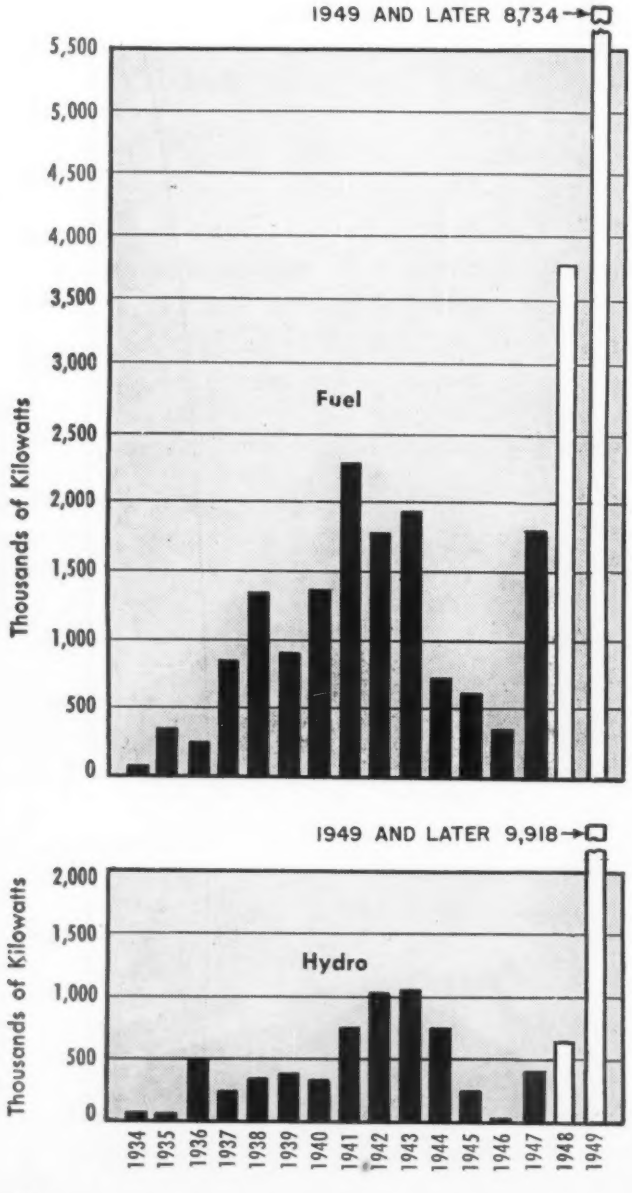
Scheduled for installation in 1948 is new capacity amounting to 4,409,044 kw. Of this, 3,791,494 kw is fuel power, over 86 percent. Hydro power, with its less than 14 percent, is in smaller proportion than in 1947 when it was about 18 percent. Although the condition does not show in the data presented here, the survey replies indicate that hydro power will not figure largely in the new capacity picture until after 1949.

In 1947, power companies installed over 73 percent of the capacity added to the public supply; under 27 percent was installed by municipal and other government undertakings. For 1948 the respective ratios will be more disparate, over 83 and under 17 percent. Again apparent in the survey replies, but not in the data here presented, is the indication that additions to government capacity will not loom large until 1949 is past.

NEW CAPACITY ADDED EACH YEAR

Year	Killowatts		
	Fuel	Hydro	Total
1933	251,025	95,325	346,350
1934	52,805	41,900	94,705
1935	347,140	38,950	386,090
1936	231,828	489,865	721,093
1937	873,414	245,346	1,118,760
1938	1,350,303	345,605	1,695,808
1939	914,680	370,150	1,284,830
1940	1,361,094	332,016	1,693,110
1941	2,292,215	786,250	3,078,375
1942	1,756,212	1,026,900	2,783,112
1943	1,835,180	1,088,900	2,924,080
1944	778,037	767,855	1,545,892
1945	621,600	265,800	887,400
1946	355,322	5,850	361,172
1947	1,783,999	392,750	2,176,749
1948	3,791,494	617,550	4,409,044
1949*	8,733,821	9,918,200	18,652,051

Source "Electrical World" Surveys. *Prospective for 1949 and later.



GENERATING CAPACITY ADDED IN 1947

STEAM

Power Companies	*Nameplate kw*
Almno Systems	67,500
Boston Edison Co	50,000
Central Illinois Electric & Gas Co	40,000
Central Power & Light Co	20,000
Commonwealth Edison & Subsidiaries	107,000
Connecticut Light & Power Co	45,000
Consolidated Edison Co of New York	57,500
Detroit Edison Co	75,000
Eastern Shore Public Service Co of Maryland	15,000
Florida Power Corp	25,000
Gulf States Utilities Co	35,000
Houston Light & Power	37,500
Indianapolis Power & Light Co	37,500
Interstate Power Co	15,000
Iowa Public Service & Sioux City Gas & Elec Co	17,500
Kentucky Utilities Co	25,000
Louisville Gas & Electric Co	60,000
Metropolitan Edison Co	48,500
Mississippi Power Co	22,500
Montana-Dakota Utilities	3,000
New England Electric System	45,000
New England Gas & Electric System	20,000
Northern State Power & Subsidiaries (Wisc)	2,000
Oklahoma Gas & Electric Co	22,500
Otter Tail Power Co	5,000
Pacific Gas & Electric Co	7,500
Pennsylvania Power Co	35,000
Philadelphia Electric Co & Subsidiaries	162,500
Potomac Edison & Subsidiaries	35,000
Potomac Electric Power Co & Subsidiaries	50,000
Public Service Co of Colorado	5,000
Public Service Co of New Hampshire	30,000
Public Service Co of New Mexico	6,000
Public Service Co of Oklahoma	30,000
Public Service Electric & Gas Co of N. J.	100,000
South Carolina Power Co	22,500
Southern California Edison Co	20,000
Southwestern Gas & Electric Co	25,000
Southwestern Public Service Co	5,900
Staten Island Edison Co	20,000
Western Colorado Power Co	3,000
Wisconsin Power & Light Co	25,000
Wisconsin Public Service Corp & Subsidiaries	30,000
	1,509,500
Municipal and Other Public Plants	
Detroit, Michigan	80,000
Dover, Ohio	4,000
Fort Collins, Colorado	7,000
Glendale, California	20,000
Hastings, Nebraska	6,000
Kansas City, Kansas	30,000
Los Angeles, California	65,000
Moorehead, Minnesota	3,000
	215,000

HYDRO

Power Companies	
Alabama Power Co	23,000
Central Hudson Gas & Electric	25,000
Idaho Power Co	99,000
Minnesota Power & Light Co	12,000
New England Electric System	30,000
Niagara Hudson Power Corp	102,500
Northern States Power Co (Wisc)	30,000
Pacific Gas & Electric Co	190,700
Pacific Power & Light Co	50,000
South Carolina Electric & Gas Co	20,000
Western Colorado Power Co	3,500
Wisconsin Public Service Co	5,000
	592,700
Municipal and Other Public Plants	
Corp of Engineers Dept of U. S. Army	7,815,000
Eugene, Oregon	12,500
Los Angeles, California	112,500
Lower Colorado River Authority, Colorado	12,500
Seattle, Washington	60,000
South Carolina Public Service Authority, S. C.	1,800
Tennessee Valley Authority	251,200
U. S. Bureau of Reclamation	1,060,000
	9,325,500

INTERNAL COMBUSTION

Power Companies	
California Pacific Utility Co	400
Community Public Service Co	1,000
Eastern Shore Public Service Co	2,425
Interstate Power Co	2,750
Iowa Public Service & Sioux City Gas & Elec Co	1,136
Lake Superior District Power Co	4,000
Michigan Public Service Co	5,516
New England Electric System	4,000
New York State Electric & Gas Co	100
Northern States Power Co (Minn)	16,000
Northwestern Public Service Co	2,272
Oklahoma Gas & Electric Co	1,000
Otter Tail Power Co	6,400
Pacific Power & Light Co	1,000
Public Service Co of New Hampshire	3,000
Tucson Gas Electric Light & Power Co	3,000
Utah Power & Light Co	750
Western Light & Telephone Co	1,250
	55,999
Municipal and Other Public Plants	
Bluffton, Indiana	2,000
Brady, Texas	1,500
	3,500

Kind of Power	*Power Companies*	*Municipal and Federal*	*Total*
Steam	1,509,500	215,000	1,724,500
Hydro	27,750	365,000	392,750
Internal Combustion	55,999	3,500	59,499
Total	1,593,249	583,500	2,176,749

GENERATING CAPACITY TO BE ADDED IN 1948

STEAM

Power Companies	*Nameplate Kw*
Almno Systems	67,500
Alpena Power Company	3,000
Central Arizona Light & Power Co	30,000
Central Illinois Light Co	35,000
Central Illinois Public Service Co	100,000
Central Power & Light Co	20,000
Cincinnati Gas & Electric Co	35,000
Cleveland Electric Illuminating Co	75,000
Connecticut Light & Power Co	62,500
Consolidated Edison Co of New York	170,000
Consolidated Gas Elec Lt & Pwr Co of Baltimore	60,000
Consumers Power Co	170,000
Dallas Power & Light Co	8,500
Dayton Power & Light Co	50,000
Duke Power Co	130,000

Florida Power Corp	25,000
Georgia Power Co	122,500
Holyoke Water & Power Co	15,000
Houston Lighting & Power Co	10,000
Interstate Power Co	15,000
Iowa Public Service & Sioux City Gas & Elec Co	10,000
Kansas City Power & Light Co	42,500
Kentucky Utilities Co	25,000
Lake Superior District Power Co	21,000
Long Island Lighting Co	40,000
Luzerne City Gas & Electric Co	23,000
Madison Gas & Electric Co	20,000
New England Gas & Electric System	15,000
New York State Electric & Gas Co	30,000
Niagara-Hudson System	180,000
Northern States Power Co (Minn)	42,500
Northern States Power Co (Wis)	10,000
Northwestern Public Service Co	6,750
Ohio Edison Co	55,000
Ohio Power Co	100,000
Oklahoma Gas & Electric Co	25,000
Otter Tail Power Co	20,000
Pacific Gas & Electric Co	160,000
Pennsylvania Electric Co	30,000
Pennsylvania Power & Light Co	150,000
Philadelphia Electric Co & Subsidiaries	222,500
Public Service Co of Colorado	40,000
Public Service Co of Indiana	35,000
Public Service Co of Oklahoma	15,000
Public Service Electric & Gas Co	200,000
Rochester Gas & Electric Co	40,000
San Diego Gas & Electric Co	50,000
Southern California Edison Co	120,000
Southwestern Gas & Electric Co	15,000
Southwestern Public Service Co	65,000
Texas Electric Service Co	70,000
Union Electric Co of Missouri & Subsidiaries	80,000
United Illuminating Co	30,000
Virginia Electric & Power Co	60,000
Western Colorado Power Co	3,500
West Penn Power Co	80,000
West Texas Utility Co	7,500
Wisconsin Electric Power Co	80,000
	3,423,250

Municipal and Other Public Plants

Austin, Minnesota	7,500
Columbia, Missouri	7,500
Fairbury, Nebraska	4,000
Jonesboro, Arkansas	7,500
Los Angeles, California	150,000
Omaha Public Power District, Nebraska	15,000
Pasadena, California	35,000
Poplar Bluff, Missouri	3,000
Provo, Utah	7,500
Richmond, Indiana	15,000
San Antonio, Texas	25,000
Traverse City, Michigan	1,750
Vineland, New Jersey	5,000
Virginia, Minnesota	5,000
Watertown, South Dakota	5,000
	293,750

HYDRO

Power Companies

Holyoke Water Power Co	250
Idaho Power Co	38,500
Nantahala Power & Light Co	1,500
Pacific Gas & Electric Co	82,700
Public Service Co of New Hampshire	15,000
South California Edison Co	35,000
Union Electric Co of Missouri & Subsidiaries	1,200
	174,150

Municipal and Other Public Plants

Corps of Engineers Dept of U. S. Army	51,000
Tennessee Valley Authority	96,400
U. S. Bureau of Reclamation	296,000
	443,400

INTERNAL COMBUSTION

Power Companies

California Pacific Utilities Co	400
Dallas Power & Light Co	6,000
Eastern Shore Public Service Co	500
Florida Power Corp	2,000
Interstate Power Co	700
Iowa Public Service & Sioux City Gas & Elec Co	10,224
Missouri Power & Light Co	4,000
Missouri Utilities Co	2,000
New York State Electric & Gas Co	100
Northern States Power Co (Minn)	11,000
Northern States Power Co (Wis)	4,600
Northwestern Public Service Co	500
Otter Tail Power Co	3,800
Southeastern Indiana Power Co	2,160
Southwestern Public Service	330
Texas Electric Service Co	6,280
Texas Power & Light Co	5,500
Western Light & Telephone Co	6,000
West Texas Utilities Co	400
Wisconsin Public Service Co	7,000
	73,494

Municipal and Other Public Plants

Ames, Iowa	1,000
	1,000

Kind of Power	*Power Companies*	*Municipal and Federal*	*Total*
Steam	3,423,250	293,750	3,717,000
Hydro	174,150	443,400	617,550
Internal Combustion	73,494	1,000	74,494
Total	3,670,894	738,150	4,409,044

GENERATING CAPACITY TO BE ADDED IN 1949 AND LATER

STEAM

Power Companies	*Name plate Kw*
Almno Systems	530,000
Alabama Power Co	120,000
Appalachian Electric Power	125,000
Boston Edison Co	81,250
Carolina Power & Light Co	80,000
Central Illinois Electric & Gas Co	20,000
Central Illinois Light Co	35,000
Central Illinois Public Service Co	60,000
Central Power & Light Co	30,000
Cincinnati Gas & Electric Co	80,000
Cleveland Electric Illuminating Co	135,000
Commonwealth Edison & Subsidiaries	407,000
Community Public Service Co	12,500
Connecticut Light & Power Co	120,000

Consolidated Edison Co of New York	290,000
Consolidated Gas Elec & Pwr Co of Baltimore	60,000
Consumers Power Co	240,000
Dallas Power & Light Co	120,000
Dayton Power & Light Co	50,000
Detroit Edison Co	300,000
Duke Power Co	140,000
Duquesne Light Co	65,000
El Paso Electric Co	20,000
Eastern Shore Public Service Co of Maryland	45,000
Empire District Electric Co	30,000
Florida Power Corp	30,000
Georgia Power Co	122,500
Gulf Power Co	22,500
Gulf States Utilities Co	140,000
Houston Lighting & Power Co	180,000
Indiana & Michigan Electric Co	125,000
Indianapolis Power & Light Co	80,000
Interstate Power Co	25,000
Iowa Public Service & Sioux City Gas & Elec Co	35,000
Jersey Central Power & Light Co	25,000
Kansas City Power & Light Co	120,000
Kentucky Utilities Co	66,000
Long Island Lighting Co	40,000
Louisville Gas & Electric Co	120,000
Metropolitan Edison Co	66,000
Minnesota Power & Light Co	33,000
Mississippi Power Co	22,500
Missouri Power & Light Co	7,500
Missouri Utilities Co	7,500
Monongahela Power Co	50,000
Montana-Dakota Utilities Co	7,500
New England Electric System	45,000
New England Gas & Electric System	30,000
New Jersey Power & Light Co	66,000
New York State Electric & Gas Co	70,000
Niagara-Hudson System	90,000
Northern Indiana Public Service Co	70,425
Northern States Power Co (Minn)	213,000
Northern States Power Co (Wis)	23,000
Northwestern Public Service Co	11,500
Ohio Edison Co	120,000
Oklahoma Gas & Electric Co	100,000
Ottertail Power Co	10,000
Pacific Gas & Electric Co	180,000
Pennsylvania Electric Co	100,000
Pennsylvania Power & Light Co	100,000
Philadelphia Electric & Subsidiaries	225,000
Potomac Edison Co & Subsidiaries	35,000
Potomac Electric Power Co & Subsidiaries	160,000
Public Service Co of Colorado	80,000
Public Service Co of Indiana	80,000
Public Service Co of New Hampshire	40,000
Public Service Co of New Mexico	11,500
Public Service Co of Oklahoma	30,000
Public Service Electric & Gas Co of New Jersey	200,000
Rochester Gas & Electric Co	40,000
San Diego Gas & Electric Co	50,000
Savannah Electric & Power Co	20,000
South Carolina Power Co	22,500
Southern California Edison Co	120,000
Southern Colorado Power Co	15,000
Southern Indiana Gas & Electric Co	20,000
Southwestern Gas & Electric Co	89,000
Southwestern Public Service Co	62,500
Staten Island Edison Corp	20,000
Texas Electric Service Co	103,500
Texas Power & Light Co	75,500
Tucson Gas Electric Light & Power Co	20,000
Union Electric Co of Missouri and Subsidiaries	160,000
United Illuminating Co	30,000
Utah Power & Light Co	40,000
Virginia Electric & Power Co	220,000
Western Light & Telephone Co	6,000
Western Massachusetts Electric Co	45,000
West Penn Power Co	80,000
West Texas Utilities Co	35,000
Wisconsin Electric Power Co	80,000
Wisconsin Power & Light Co	25,000
Wisconsin Public Service Corp & Subsidiaries	110,000
	8,200,175

Municipal and Other Plants

Ames, Iowa	15,000
Burbank, California	20,000
Cleveland, Ohio	50,000
Colorado Springs, Colorado	10,000
Danville, Virginia	6,000
Detroit, Michigan	44,000
Glendale, California	20,000
Grand Island, Nebraska	7,500
Holyoke, Massachusetts	7,500
Lakeland, Florida	20,000
Los Angeles, California	75,000
Menaska, Wisconsin	8,000
Nebraska Public Power System	60,000
Norwich, Connecticut	7,500
Omaha Public Power District, Nebraska	30,000
Ottawa, Kansas	7,500
Pasadena, California	40,000
Provo, Utah	10,000
Rochester, Minnesota	15,000
San Antonio, Texas	30,000
Sanitary District of Chicago, Illinois	10,000
Taunton, Massachusetts	8,000
Watertown, South Dakota	8,000
	509,000

HYDRO

Power Companies

California-Oregon Power Co	27,000
Holyoke Water Power Co	250
Idaho Power Co	16,500
Michigan Public Service Co	1,000
Pacific Gas & Electric Co	10,000
	27,750

Municipal and Other Public Plants

Tennessee Valley Authority	32,000
U. S. Bureau of Reclamation	333,000
	365,000

INTERNAL COMBUSTION

Power Companies

Eastern Shore Public Service Co of Md	489
Gulf States Utilities Co	4,900
Interstate Power Co	2,000
Iowa Public Service & Sioux City Gas & Elec Co	3,272
Northwestern Public Service Co	2,000
Otter Tail Power Co	3,000
Southeastern Indiana Power Co	2,160
Western Light & Telephone Co	4,000
	21,821

Municipal and Other Public Plants

Hudson, Mass.	3,000
	3,000

Kind of Power	Power Companies	Municipal and Other Public Plants	Totals
Steam	8,200,175	509,000	8,709,000
Hydro	592,700	9,325,500	9,918,200
Int. Comb.	21,821	3,000	24,821
Totals	8,814,696	9,837,500	18,652,021

NUMBER AND INSTALLED CAPACITY OF ELECTRIC UTILITY GENERATING PLANTS BY STATES AND TYPE OF PRIME MOVER

Preliminary as of November 1, 1947

Division and State	Number of Utilities	Number of Plants	Total Capacity Kilowatts	Generator Capacity in Kilowatts of Plants Operated by[a]					
				Water Power		Steam Power		Internal Combustion Engines	
				Number	Capacity	Number	Capacity	Number	Capacity
UNITED STATES	[b]1,650	[a]3,860	51,647,107	1,482	14,861,602	1,048	35,530,050	1,330	1,255,455
New England	105	304	3,283,150	215	892,221	64	2,363,545	25	27,384
Maine	21	80	352,413	62	245,867	6	102,000	12	4,546
New Hampshire	12	51	302,475	43	232,965	5	67,930	3	1,580
Vermont	20	69	178,489	60	160,247	6	13,550	3	4,692
Massachusetts	36	67	1,374,542	31	163,172	31	1,200,125	5	11,245
Rhode Island	[b] 6	10	282,421	4	3,250	5	278,950	1	221
Connecticut	10	27	792,810	15	86,720	11	700,990	1	5,100
Middle Atlantic	116	363	10,730,213	197	1,584,615	134	9,103,482	32	42,116
New York	57	218	5,423,570	160	1,155,540	43	4,239,675	15	28,355
New Jersey	14	25	1,581,147	3	7,270	17	1,570,175	5	3,702
Pennsylvania	45	120	3,725,496	34	421,805	74	3,293,632	12	10,059
East North Central	313	675	11,994,391	293	740,498	243	11,088,228	139	165,665
Ohio	67	103	3,256,588	6	11,525	76	3,226,459	21	18,604
Indiana	53	82	1,645,624	21	35,444	44	1,586,040	17	24,140
Illinois	64	96	3,323,909	12	49,414	60	3,246,959	24	27,536
Michigan	67	203	2,473,939	131	367,101	30	2,045,225	42	61,613
Wisconsin	62	191	1,294,331	123	277,014	33	983,545	35	33,772
West North Central	489	890	3,604,224	132	561,966	214	2,568,137	544	474,121
Minnesota	82	162	775,327	44	126,023	48	582,324	70	66,980
Iowa	99	190	833,057	32	133,086	49	573,190	109	126,781
Missouri	75	114	812,129	6	150,525	28	584,108	80	77,496
North Dakota	16	46	110,673	.....	.....	17	89,338	29	21,335
South Dakota	44	76	105,203	5	3,425	11	60,862	60	40,916
Nebraska	87	165	429,340	38	142,170	27	225,985	100	61,185
Kansas	86	137	538,495	7	6,737	34	452,330	96	79,428
South Atlantic	148	390	6,696,796	159	2,221,028	121	4,377,115	110	98,653
Delaware	6	7	37,262	.....	.....	4	33,150	3	4,112
Maryland	13	30	930,815	3	271,325	14	649,525	13	9,965
District of Columbia	2	3	458,000	1	3,000	2	455,000	.....	.....
Virginia	25	69	794,831	37	181,994	15	598,255	17	14,582
West Virginia	11	35	962,505	11	100,940	14	856,610	10	4,955
North Carolina	29	79	1,354,053	48	657,570	20	684,221	11	12,262
South Carolina	15	41	790,761	28	650,644	8	134,930	5	5,187
Georgia	14	46	720,026	27	342,892	14	374,900	5	2,234
Florida	33	80	648,543	4	12,663	30	590,524	46	45,356
East South Central	62	136	3,559,973	39	2,221,480	58	1,317,134	39	21,359
Kentucky	16	32	664,191	4	238,860	23	423,176	5	2,155
Tennessee	15	38	1,444,878	23	1,023,057	10	419,450	5	2,371
Alabama	6	30	1,348,333	12	959,563	11	384,940	7	3,830
Mississippi	25	36	102,571	.....	.....	14	89,568	22	13,003
West South Central	176	398	2,995,871	36	385,247	100	2,362,491	262	248,133
Arkansas	23	41	256,315	6	102,008	14	132,445	21	21,862
Louisiana	34	62	650,177	.....	.....	13	599,520	49	50,657
Oklahoma	52	100	532,662	4	73,624	23	400,926	73	58,112
Texas	67	195	1,556,717	26	209,615	50	1,229,600	119	117,502
Mountain	180	418	2,707,538	198	2,021,293	67	562,763	153	123,482
Montana	18	36	373,296	21	358,313	4	11,968	11	3,015
Idaho	15	52	287,368	43	282,446	1	400	8	4,522
Wyoming	30	53	83,717	15	49,520	11	27,560	27	6,637
Colorado	42	86	337,676	30	86,585	24	232,648	32	18,443
New Mexico	22	47	177,666	6	25,090	13	126,762	28	25,814
Arizona	18	52	681,364	15	540,759	10	94,675	27	45,930
Utah	27	77	175,294	58	92,445	4	68,750	15	14,099
Nevada	8	15	591,157	10	586,135	.....	.....	5	5,022
Pacific	61	286	6,074,951	213	4,233,254	47	1,787,155	26	54,542
Washington	20	58	1,738,855	41	1,534,212	10	202,320	7	2,323
Oregon	18	70	904,326	52	712,807	12	186,810	6	4,709
California	23	158	3,431,770	120	1,986,235	25	1,398,025	13	47,510

Notes: [a] For the approximately 170 combination plants each type of prime mover is counted as a separate plant.
[b] Total includes 84 duplications because of utilities having generating plants in more than one state.
Source: Federal Power Commission.

MAINTENANCE

$323,465,000

ACCORDING to present estimate, maintenance cost per kw of installed capacity will be between $6 and $7 in 1948, around a dollar more than in 1947. Rises in costs of materials and labor account for part of the increase, and heavy loading of equipment for the remainder. The cost rise is of the order of 50 percent over prewar. These are indications from Electrical World's annual survey of utility expenditures.

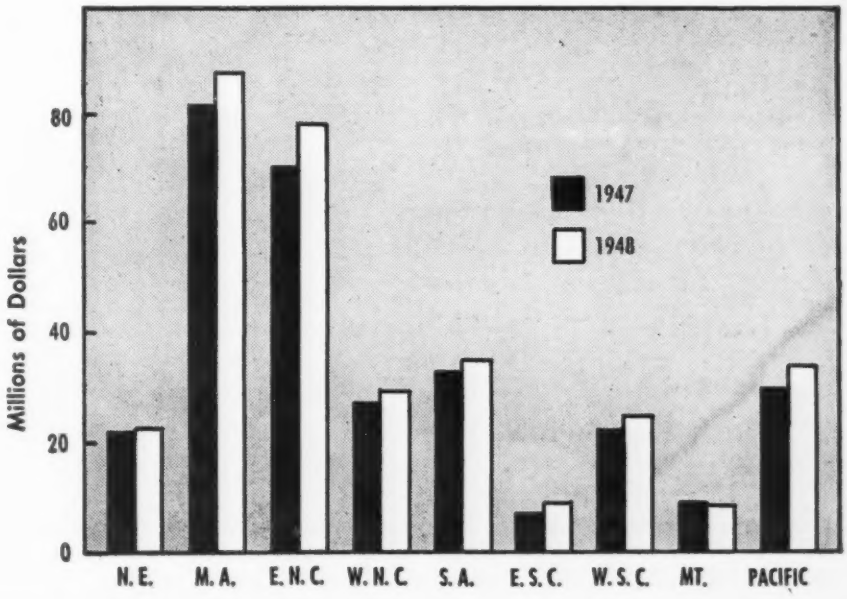
The Federal Power Commission data on this page end with 1946, but they show a trend of rising proportion of total maintenance cost going to production plant. Over the 8-year period, 1939-1946 inclusive, production plant averaged 39.3 percent of total maintenance cost. In 1946 the ratio was 45.9. It may be that the trend will not be continued upward by the 1947 figures when they become available, because of the difficulty of taking machines out of service to work on them.

Distribution is getting a lesser share of the maintenance dollar. For the 8-year period, it averaged 47.6 cents, but in 1946 its share was down to 40.6 cents.

MAINTENANCE EXPENDITURES
1947
(Thousands of Dollars)

Regions	1947	1948*
New England	21,314	22,729
Middle Atlantic	82,140	86,982
E. N. Central	70,341	28,315
W. N. Central	26,773	28,540
South Atlantic	31,468	34,176
E. S. Central	6,582	8,822
W. S. Central	22,027	23,383
Mountain	8,944	8,171
Pacific	29,077	32,797
United States	298,666	323,465

Source: "Electrical World" Surveys.
* Estimated



MAINTENANCE EXPENDITURES
Privately Owned Class A and B Electric Utilities in The United States
(In Thousands of Dollars)

Plant Accounts	1939	1940	1941	1942	1943	1944	1945	1946	Total	Percent
Steam Power	33,240	36,222	40,397	44,775	53,258	72,825	79,751	77,327	437,795	35.2
Hydraulic Power	5,985	5,995	6,369	6,152	7,955	10,583	12,033	11,287	66,359	5.4
Int. Comb. Eng. Power	659	731	702	759	809	1,020	1,116	1,365	7,161	0.6
Transmission	10,487	11,298	12,215	13,456	14,921	16,151	16,753	18,846	114,127	9.2
Distribution	62,027	63,789	65,446	66,108	69,624	76,700	79,416	91,484	574,594	46.4
General Properties	4,101	4,110	4,091	4,023	4,473	5,243	6,445	6,926	39,412	3.2
Total	116,499	122,145	129,220	135,273	151,040	182,522	195,514	207,235	1,239,448	100.0

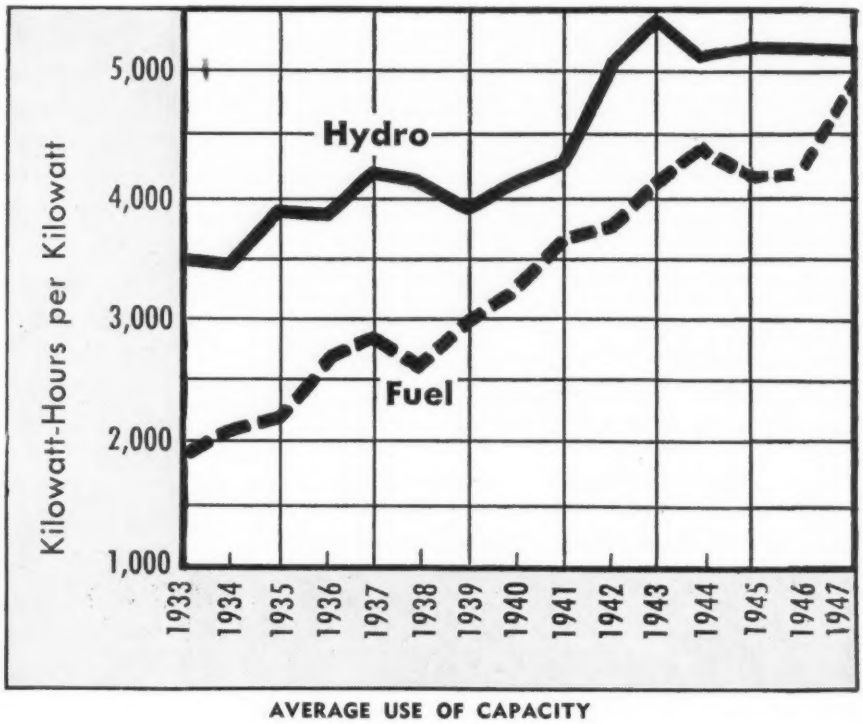
Source: Federal Power Commission.

STATION ECONOMICS

1.3 Pounds of Coal per Kwhr

GENERAL INADEQUACY of generating capacity is manifesting itself in no more convincing terms than the greatly increased hours of equipment operation. Combined hydro and steam capacity was worked to the tune of 5,009 hours per year. The brunt of the increased output per unit of capacity was borne by the fuel plants. These plants on the average were producing at full output for 4,905 hours. That is a sustained functioning 12 percent higher than the active war-year 1943.

Bearing of this index upon the current retention of old, inefficient and obsolescent facilities can be sensed from the fact that it was not until the war was well under way that equipment, on the average, was operated more than 45 percent of the time. Fuel-powered plants are now at a 56 percent level. Manifestly the industry has been learning how to get along with less and less reserve capacity but its present problem is to get along at all until more reserve capacity will be available to relieve present overtaxed facilities. A few years hence it will probably prove advantageous to retire the old equipment but not until reserves have caught up.



AVERAGE USE OF CAPACITY

OUTPUT, CAPACITY, AVERAGE USE

Year	Energy Generated (Millions of Kw.-Hr.)			Generating Capacity at end of year (Thousands of Kw.)			Output per Kw. Of Ave. Cap. (Kw.-Hr.)		
	Fuel	Water	Total	Fuel	Water	Total	Fuel	Water	Total
1934.....	57,093	33,713	90,806	26,049	9,742	35,791	2,173	3,462	2,521
1935.....	59,430	39,034	98,464	26,279	9,795	36,074	2,271	3,996	2,740
1936.....	72,665	39,516	112,181	26,128	10,436	36,564	2,773	3,906	3,089
1937.....	77,348	44,489	121,837	26,558	10,577	37,135	2,936	4,234	3,306
1938.....	71,847	44,834	116,681	27,976	11,066	39,042	2,635	4,143	3,063
1939.....	86,314	44,022	130,336	28,903	11,415	40,318	3,035	3,916	3,285
1940.....	97,232	47,753	144,985	29,964	11,675	41,639	3,303	4,137	3,538
1941.....	116,908	51,262	168,170	31,828	12,264	44,092	3,784	4,284	3,923
1942.....	125,002	64,179	189,181	33,381	13,025	46,407	3,834	5,076	4,181
1943.....	147,027	73,943	220,970	35,237	14,068	49,305	4,285	5,458	4,617
1944.....	156,704	74,032	230,736	35,671	14,604	50,275	4,392	5,164	4,634
1945.....	142,516	79,970	222,486	35,199	14,912	50,111	4,021	5,419	4,433
1946.....	144,772	78,406	223,178	35,468	14,849	50,317	4,097	5,262	4,445
1947*....	177,211	78,183	255,394	36,785	14,862	51,647	4,905	5,263	5,009

Source: Federal Power Commission. *Energy generated estimated for full year; generating capacity to November 1.

Hydro plants had water enough to contribute as much as in 1946 but fell 3.5 percent short of the help they rendered in 1943; it appears that 1947 instead of having a propitious rainfall and run-off was a bit below par. Fuel plants bore the stress.

Proficiency in converting fuel energy to electrical energy has made little gain since the country engaged in war in 1941. That pro-

fiency has hovered around 1.30 and 1.29 during 1942-7, the latter year's index being 1.30 pounds of coal per kilowatt hour. It should be noted that the accompanying table presents completely revised data for 1935-47.

Equipment Improvement

There are numerous reasons why the advances in the art of designing equipment and of burning the fuel have not improved the proficiency. Several of these warrant the use of the term "proficiency" rather than "efficiency" because non-technical factors are involved.

On the favorable side have been improvement in equipment, progressive use of larger-sized, more efficient facilities and longer hours of operation. On the debit side have been poorer quality of fuel, continued operation of obsolescent, inefficient machines and handicap to upkeep while the capacity shortage exists.

Never before have the power systems used so much coal and fuel oil. Natural gas burned under boilers was about the same as in 1944. Coal tonnage was 8 percent more than for 1944 and 20 percent more than during the year 1946.

Fuel Oil Consumption

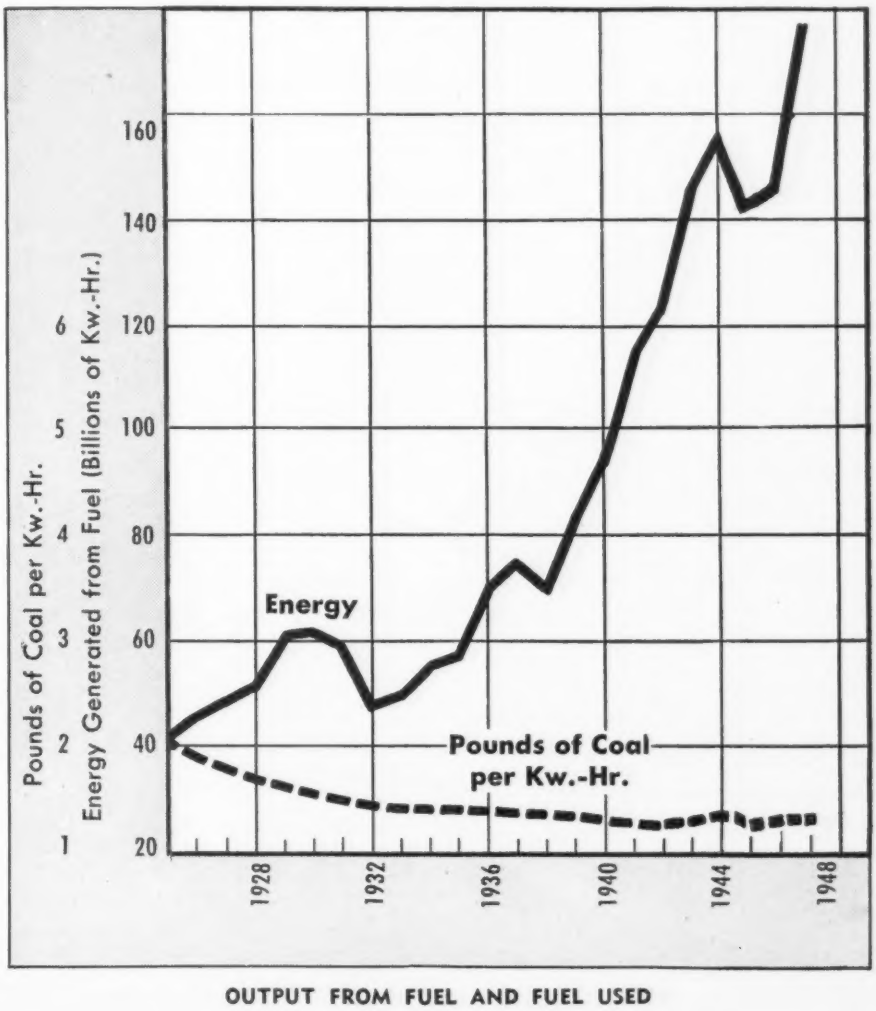
Although electric utilities take less than 10 percent of the nation's fuel oil production, they are undoubtedly a factor in the tightening situation as regards this fuel. Resulting from the post-war coal strikes and the rising cost of coal, there has been a significant turning to oil as a power plant fuel. This is plainly to be seen in the large increase of fuel oil consumed shown in the table of fuel usage.

Based on 1939 figures, fuel plant output in 1947 reached an index of 206. Coal consumed did not rise so high nor did gas burned. Their 1947 indexes are 194 and 163 respectively. But the index of oil consumed went up to 273. Thus the utilities have been increasing their use of fuel oil at a rate faster than their output from fuel has been rising.

OUTPUT FROM FUEL AND FUEL USED

Year	Energy Generated From Fuel† (Millions of Kw.-Hr.)	Fuel Consumed				
		Coal (Millions of Tons)	Oil (Millions of Bbl.)	Gas (Billions of Cu. Ft.)	†† Coal Equiv. (Millions of Tons)	Pounds of Coal per Kw.-Hr.†
1935.....	56,689	32.71	11.26	124.12	40.80	1.44
1936.....	69,823	40.09	14.08	154.08	50.14	1.44
1937.....	74,502	42.93	13.83	169.13	53.56	1.44
1938.....	69,255	38.39	12.94	165.50	48.56	1.40
1939.....	83,628	44.54	17.14	188.88	57.60	1.38
1940.....	93,963	51.47	16.33	180.10	62.94	1.34
1941.....	113,272	62.67	20.08	201.76	75.70	1.34
1942.....	121,585	66.26	15.24	235.21	79.08	1.30
1943.....	143,785	77.30	17.99	301.94	93.27	1.30
1944.....	153,868	80.08	20.86	358.78	99.25	1.29
1945.....	142,331	74.72	20.23	326.21	92.64	1.30
1946.....	144,555	72.20	36.32	306.94	93.47	1.29
1947*....	172,384	86.56	46.87	357.68	112.37	1.30

Source: Federal Power Commission. * Twelve months ended October 31.
† Output by use of wood not included except for small amount in 1946 estimate. †† Coal plus oil plus gas.



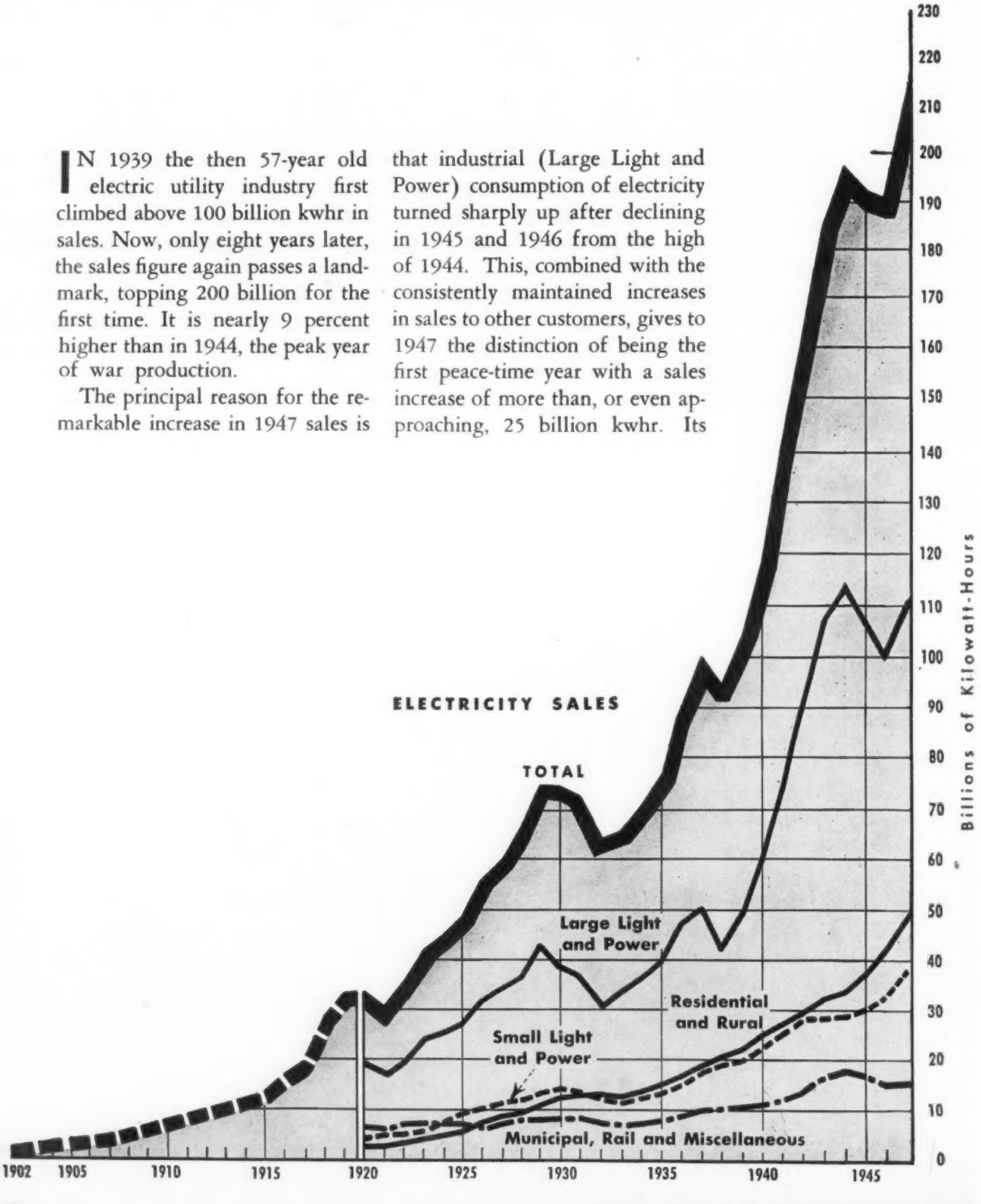
OUTPUT FROM FUEL AND FUEL USED

ENERGY SALES

215,825,000,000 Kwhr

IN 1939 the then 57-year old electric utility industry first climbed above 100 billion kwhr in sales. Now, only eight years later, the sales figure again passes a landmark, topping 200 billion for the first time. It is nearly 9 percent higher than in 1944, the peak year of war production.

The principal reason for the remarkable increase in 1947 sales is that industrial (Large Light and Power) consumption of electricity turned sharply up after declining in 1945 and 1946 from the high of 1944. This, combined with the consistently maintained increases in sales to other customers, gives to 1947 the distinction of being the first peace-time year with a sales increase of more than, or even approaching, 25 billion kwhr. Its



only peer is the war year of 1943, when the increase was a little over 26 billion.

The rapid rise in Large Light and Power sales from 99 billion kwhr in 1946 to 112 billion in 1947 testifies to the great industrial expansion that has taken place since the war. To appreciate fully the significance of this increase, consider the sales to these customers in 1944. Then, production was all out for war. Three-shift operation of industrial plants was common. Every facility of production was utilized to the utmost. And industrial usage of electricity reached a peak of 115 billion kwhr. In 1947 usage came within 3 billion of the peak. Although there was pressure for production by market demands, there was not the desperate urgency of the war year. Labor was not working so hard or so long. Multiple-shift operation was infrequent. Many more people were employed. And shortages of various kinds still persisted. One is forced to the conclusion that the upsurge of industrial consumption of electricity in 1947 must have resulted primarily from a great increase in productive capacity.

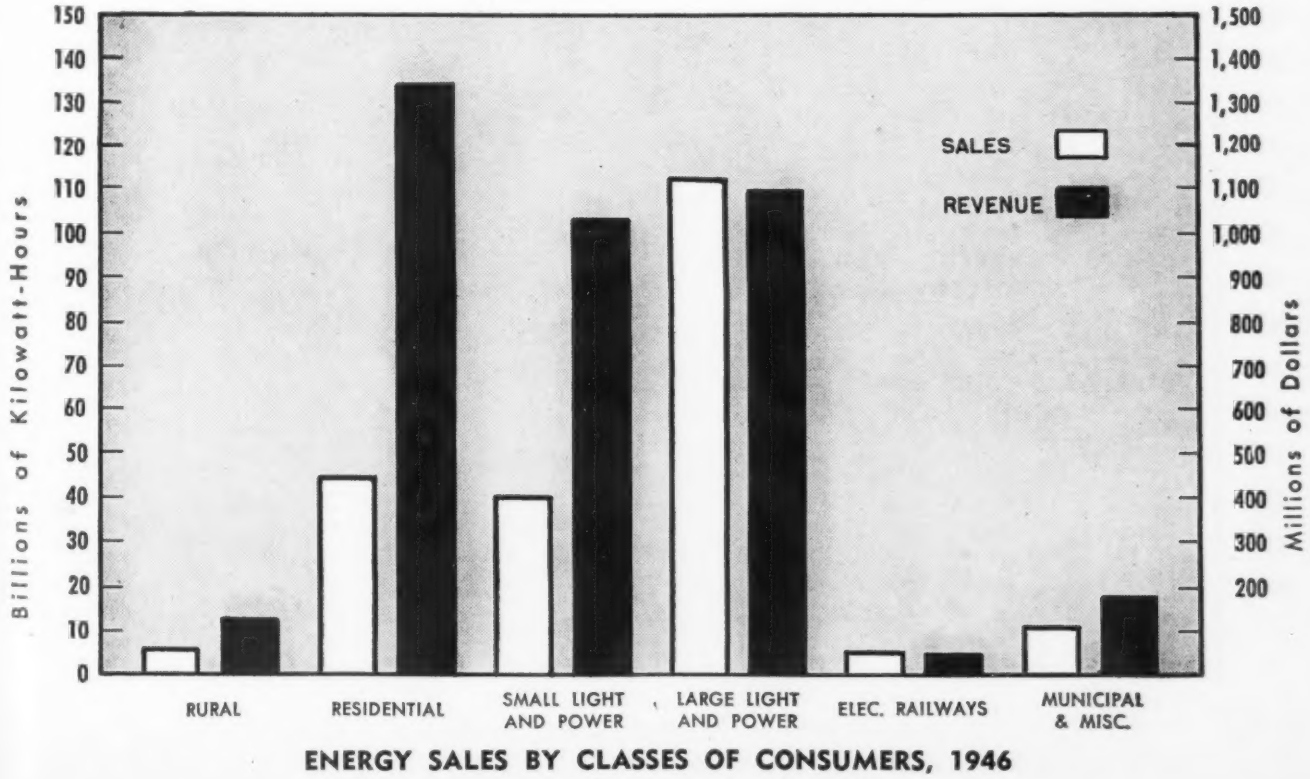
ENERGY SALES TO ULTIMATE CONSUMERS

(In Millions of Kw.-Hr.)

Year	Rural	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total to Ultimate Consumers
1934..	1,858	12,233	12,278	36,943	1,896	4,237	692	945	71,082
1935..	1,693	13,496	13,588	40,864	2,078	4,194	841	842	77,596
1936..	2,138	14,992	15,612	48,655	2,223	4,401	1,115	908	90,044
1937†.	1,670	17,691	18,075	51,360	1,863	4,428	1,284	2,987	99,359
1938..	1,577	19,371	19,137	43,140	1,929	3,989	1,449	3,138	93,731
1939..	1,881	21,084	20,722	51,108	2,002	3,918	1,847	3,205	105,768
1940..	1,991	23,318	22,373	59,557	2,048	3,974	1,935	3,447	118,643
1941..	2,352	25,124	24,628	76,060	2,111	3,960	2,118	3,707	140,060
1942..	2,890	26,937	27,234	88,378	2,061	4,256	2,372	5,280	159,408
1943..	2,996	28,621	28,192	106,657	2,075	4,696	2,530	10,122	185,889
1944..	3,373	31,266	29,837	115,187	2,163	4,635	2,694	9,006	198,161
1945..	3,668	34,184	30,438	107,490	2,184	4,683	2,671	8,240	193,558
1946..	4,431	38,571	33,016	98,885	2,272	4,515	2,632	5,473	190,794
1947..	5,625	44,000	38,225	112,100	2,350	4,500	2,650	6,375	215,825

Source: Edison Electric Institute. * Estimated. † Revised figures to conform with Uniform System of Accounts prescribed by Federal Power Commission from 1937.

During the past year the growth of residential usage of electricity not only continued, but accelerated markedly. The increase from 1946 sales of over 38 billion kwhr to these customers to the 1947 figure of 44 billion is the largest in any year of record. Some of this increase is attributable to growth in number of residential customers. But probably the greater part of it resulted from larger use of energy per customer, appliances having become more easily available.

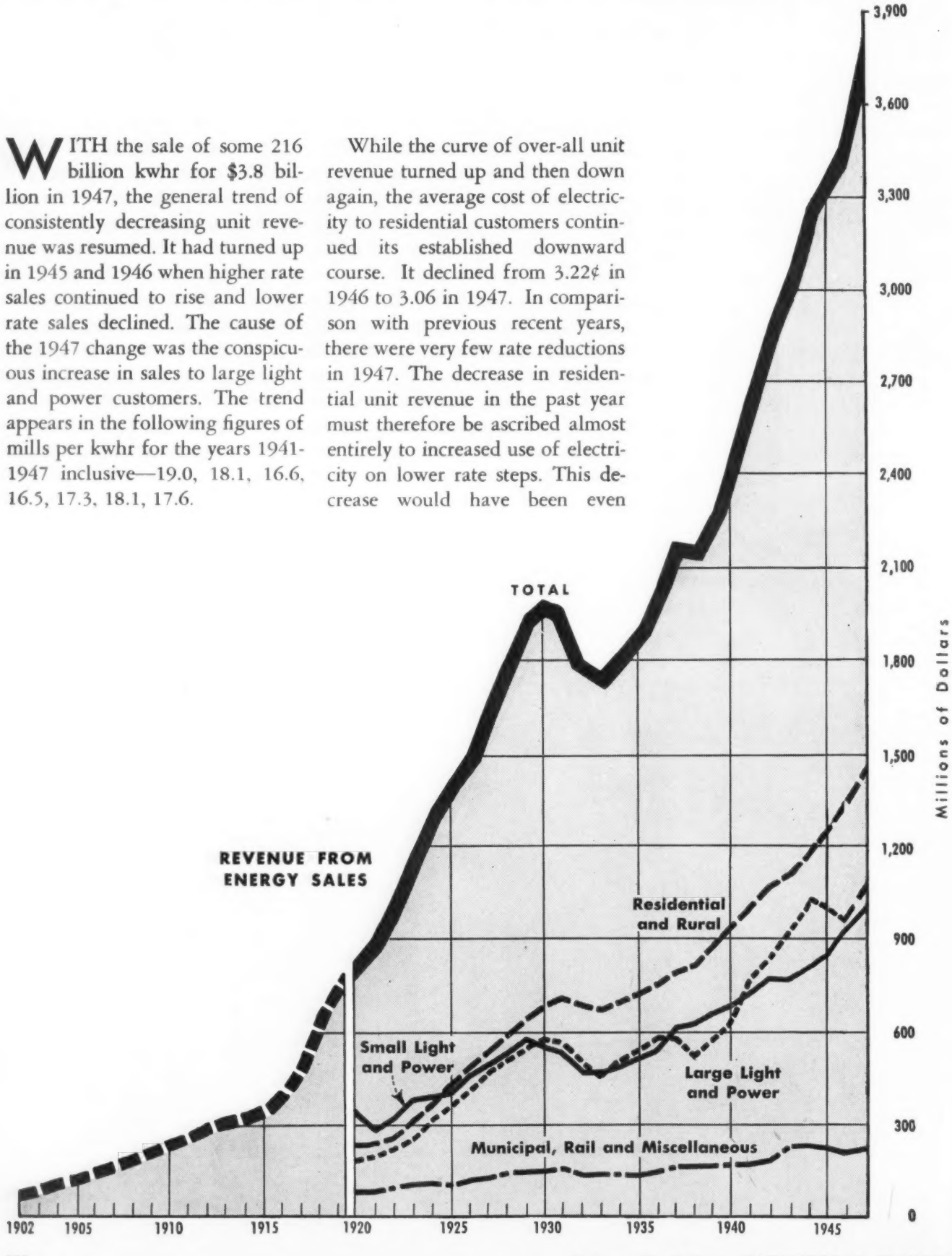


ENERGY SALES BY CLASSES OF CONSUMERS, 1946

REVENUE... $3,800,000,000

WITH the sale of some 216 billion kwhr for $3.8 billion in 1947, the general trend of consistently decreasing unit revenue was resumed. It had turned up in 1945 and 1946 when higher rate sales continued to rise and lower rate sales declined. The cause of the 1947 change was the conspicuous increase in sales to large light and power customers. The trend appears in the following figures of mills per kwhr for the years 1941-1947 inclusive—19.0, 18.1, 16.6, 16.5, 17.3, 18.1, 17.6.

While the curve of over-all unit revenue turned up and then down again, the average cost of electricity to residential customers continued its established downward course. It declined from 3.22¢ in 1946 to 3.06 in 1947. In comparison with previous recent years, there were very few rate reductions in 1947. The decrease in residential unit revenue in the past year must therefore be ascribed almost entirely to increased use of electricity on lower rate steps. This decrease would have been even



REVENUE FROM ELECTRICITY SALES

(Thousands of Dollars)

Year	Rural‡	Residential	Small Light and Power	Large Light and Power	Street and Highway Lighting	Street and Interurban Electric Railways	Electrified Divisions of Steam Railroads	Municipal and Miscellaneous	Total from Ultimate Consumers
1934	49,182	648,801	490,420	499,451	81,846	36,402	6,680	19,085	1,831,870
1935	48,404	673,526	519,213	531,106	79,429	36,431	7,944	15,933	1,911,988
1936	59,286	696,997	562,122	581,148	80,791	37,423	9,591	17,225	2,044,586
1937†	37,726	759,824	616,438	583,197	72,740	37,019	10,761	43,091	2,160,798
1938†	38,928	802,532	632,091	518,694	74,323	33,512	11,995	44,504	2,156,580
1939†	45,484	843,158	660,683	572,659	75,443	32,573	14,427	45,154	2,289,583
1940†	49,473	895,951	689,253	631,428	76,052	32,740	15,068	50,252	2,440,218
1941	64,396	938,229	725,117	758,083	76,949	32,471	16,474	53,338	2,665,057
1942	75,027	990,185	767,279	828,318	75,660	35,343	18,289	65,742	2,885,843
1943	76,617	1,029,260	769,490	968,378	75,384	38,278	19,820	100,415	3,077,643
1944	82,842	1,097,726	817,355	1,043,392	76,626	38,672	21,602	98,537	3,276,752
1945	90,344	1,167,356	850,213	1,001,957	76,189	39,787	21,677	93,995	3,341,518
1946	104,876	1,240,577	924,775	969,348	77,570	39,060	21,228	82,125	3,459,560
1947*	126,000	1,346,000	1,020,000	1,085,000	78,000	40,000	22,000	83,000	3,800,000

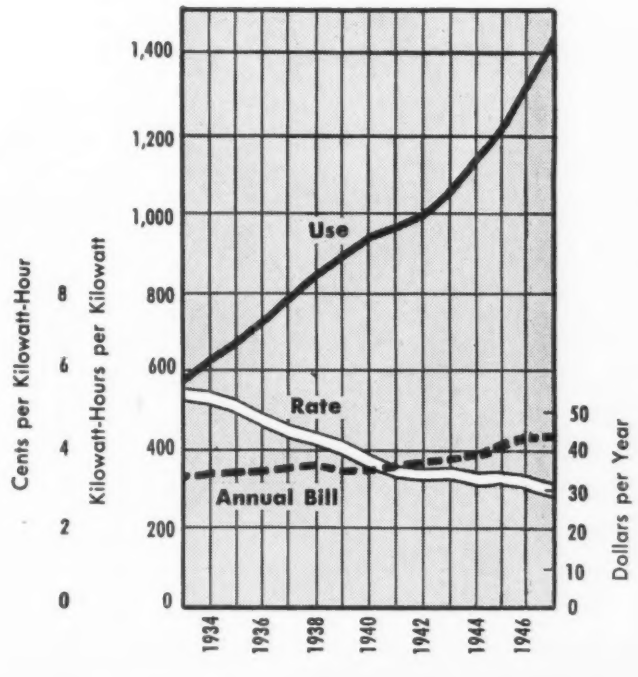
Source: Edison Electric Institute. * Estimated. † Uniform System of Accounts prescribed by Federal Power Commission begins new series of figures in 1937. ‡ Specific rural rates only.

greater were it not for the large number of new residential customers connected during the year.

In the discussion of energy sales on another page of this number, the point is made that the sharp upturn in sales to large light and power customers in 1947 shows the large post-war expansion of industrial production capacity. This thesis receives additional evidence from examination of revenue from these customers. In 1947 the average revenue per kwhr was 9.7 mills. In 1944, when sales to these customers were less than 3 percent higher than in 1947, the unit revenue was 9.1 mills, 6 percent lower. It follows that more energy was sold on higher rate steps to more customers in 1947 than in 1944.

A revenue milestone was passed in 1947. For the first time, revenue from Small Light and Power customers rose above $1 billion. Now the three largest customer groups all have revenues in 7 figures. The largest dollar increase in 1947 is in revenue from large light and power customers, a conspicuous reversal from the decline in this revenue through 1945 and 1946.

AVERAGES FOR RESIDENTIAL SERVICE



RESIDENTIAL SERVICE TO URBAN AND NON-FARM HOMES

Yea	Kw.-Hr. per Customer	Average Annual Bill (Dollars)	Revenue per Kw.-Hr. (Cents)
1935	672	33.53	4.99
1936	727	33.81	4.65
1937	805	34.62	4.30
1938	853	35.31	4.14
1939	897	35.88	4.00
1940	952	36.56	3.84
1941	986	36.78	3.73
1942	1,012	37.51	3.67
1943	1,070	38.50	3.60
1944	1,151	40.40	3.51
1945	1,229	41.97	3.41
1946	1,329	42.79	3.22
1947*	1,435	43.90	3.06

Source: Edison Electric Institute. * Estimated.

CUSTOMERS

Another Large Increase in 1947

BY THE STATISTICS about one in every 3½ persons—men, women and children—in this country is an electric utility customer. The number of customers at the end of 1947, estimated on the figures of 10 months, is 38,370,000, an increase of 2,129,709 over 1946.

In previous discussions on this page of Electrical World's annual statistical number, it has been pointed out that the figures of rural customers in the table below are not correct. Actually the number of farm and other rural customers served by electric utilities is nearly a million more than appears in the table. The 1947 decrease in rural customers was due to rate reclassification by one company.

Most farm and other rural customers are really residential customers. It is permissible, therefore, to combine the two classifications under the one heading of residential. Doing this, the number of domestic users of electricity becomes 33,070,000, which is 1,919,602 more than in 1946. In that year the increase was 1,798,954. The difference between the two increases is evidence of greater activity in dwelling construction in 1947.

As regards commercial and industrial customers the evidence runs in the counter direction. In 1946 the increase in this class was 306,990. In 1947 it was 298,488. This says that the number of new ventures in business is declining, not precipitately but definitely. In 1945 the increase was over twice what it was in 1945. The 1947 increase indicates that the post-war rush of establishment of new business enterprises is spending itself.

CENTRAL STATION CUSTOMERS AT END OF YEAR*

	United States	New England	Middle Atlantic	East No. Central	West No. Central	South Atlantic	East So. Central	West So. Central	Mountain	Pacific
Total										
1947	38,370,000	2,895,000	8,810,000	8,560,000	3,620,000	4,150,000	1,975,000	2,970,000	1,195,000	4,195,000
1946	36,140,291	2,754,950	8,494,109	8,204,347	3,410,355	3,805,064	1,801,707	2,674,418	1,104,604	3,890,737
Change	2,129,709	141,050	315,891	355,653	209,645	344,936	173,293	295,582	90,396	304,263
Rural†										
1947	1,520,000	11,500	33,000	416,700	183,900	130,100	126,000	198,500	34,400	385,900
1946	1,381,291	9,217	70,046	374,229	161,544	114,140	102,895	168,255	26,379	354,586
Change	138,709	2,283	−37,046	42,471	22,356	15,960	23,105	30,245	8,021	31,314
Residential										
1947	31,550,000	2,500,000	7,500,000	7,070,000	2,895,000	3,455,000	1,610,000	2,345,000	985,000	3,190,000
1946	29,769,107	2,378,710	7,213,584	6,830,389	2,733,340	3,155,329	1,471,841	2,109,450	915,293	2,961,171
Change	1,780,893	121,290	286,416	249,611	161,660	299,671	138,159	235,550	69,707	228,829
Commercial & Industrial										
1947	5,166,000	374,000	1,253,000	1,044,000	528,000	551,000	228,000	414,000	172,000	602,000
1946	4,867,512	359,187	1,187,459	974,000	502,705	523,169	216,598	385,280	160,286	557,828
Change	298,488	14,813	65,541	70,000	25,295	27,831	11,402	28,720	1,714	44,172
Municipal, Rail & Miscellaneous										
1947	134,000	9,500	24,000	29,300	13,100	13,900	11,000	12,500	3,600	17,100
1946	122,381	7,836	23,020	25,720	11,766	12,426	10,373	11,433	2,646	17,152
Change	11,619	1,664	980	3,580	1,334	1,474	627	1,067	954	−52

* 1947 Estimated. † Customers served on specific rural rates; rural customers served on urban rates not included.

FINANCIAL

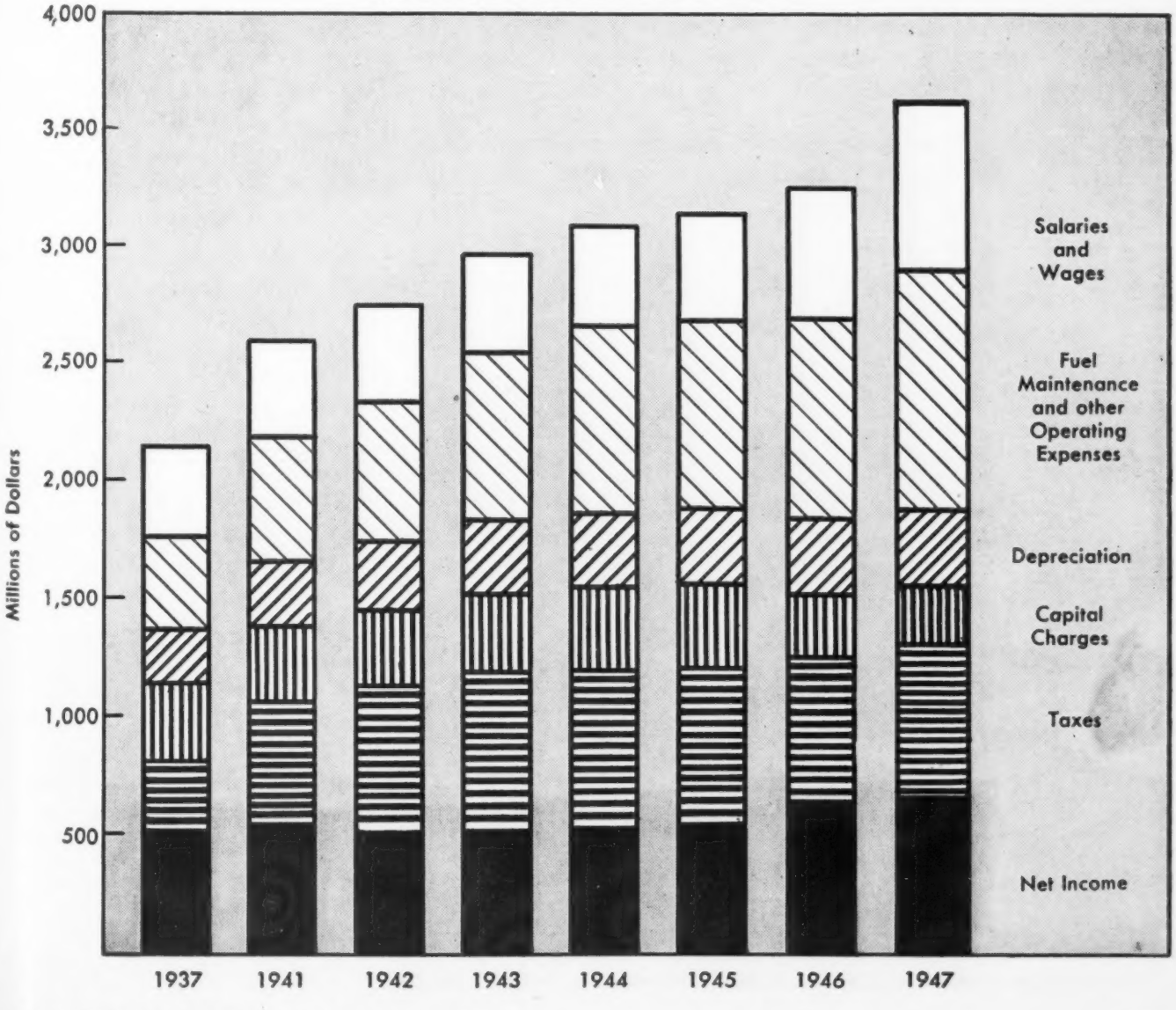
Income and Expenses

THE YEAR 1947 saw net earnings of the electric light and power companies fall for the first time since 1942 despite record revenues. The industry's gross operating revenue increased markedly, but rising expenses offset the increased income.

The industry's consolidated income statement, as set forth on the next page, shows the gross operating revenue climbing $338 million over the 1946 total. This reflects the heavy power output of 1947, since rates changed only slightly. The gain is cancelled out, however, by an increase of $326 million in operating expenses and slightly higher allowances for depreciation. Operating income before taxes is estimated about the same as it was in 1946.

Among the expense items which have been steadily climbing, the

DISTRIBUTION OF GROSS REVENUE



COMPOSITE INCOME STATEMENT
ELECTRIC LIGHT AND POWER COMPANIES

(Millions of Dollars)

	1937	1941	1945	1946	1947*
Gross Operating Revenue	**2,031**	**2,467**	**3,012**	**3,127**	**3,465**
Operating Expenses	781	947	1,259	1,385	1,711
Depreciation	216	279	322	324	336
Total Expenses	**997**	**1,226**	**1,581**	**1,709**	**2,047**
Operating Income before Taxes	**1,034**	**1,241**	**1,431**	**1,418**	**1,418**
Taxes	308	520	652	639	655
Operating Income after Taxes	**726**	**721**	**779**	**779**	**763**
Other Income	113	128	126	130	122
Gross Income	**839**	**849**	**905**	**909**	**885**
Capital Charges	330	312	360	259	242
Net Income	**509**	**537**	**545**	**650**	**643**
Of Which:					
To Dividends	434	437	415	467	472
To Surplus	75	100	130	183	171

*Estimated.
Source: Federal Power Commission and Edison Electric Institute.

greatest upsurge has occurred in fuel costs. The industry's fuel bill for 1947 rose more than 40 percent over 1946. It went up from $427 million to $604 million. At the same time, wages rose from $603 million to $710 million. Taxes increased $16 million during the year and non-operating revenues fell. Offsetting these changes, but only in part, was a reduction in capital charges of $17 million.

COMPOSITE YEAR-END BALANCE SHEET
ELECTRIC UTILITY COMPANIES

(Class A and B)

	Millions of Dollars		
	1946	1945	1941
ASSETS:			
Electric Plant and Adjustments	12,422	12,176	11,071
Gas Plant and Adjustments	1,359	1,333	1,279
Other Utility Plant and Adjustments	482	491	458
Unclassified and Undistributed	689	491	1,929
Total Utility Plant	14,952	14,491	14,737
Investment and Fund Accounts	1,067	1,089	1,321
Current and Accrued Assets	1,727	1,696	1,217
Deferred Debits	254	264	422
Capital Stock Discount and Expenses	34	36	42
Reacquired Securities	50	57	56
Total Assets	18,083	17,633	17,795
LIABILITIES:			
Capital Stock	5,939	6,062	6,614
Long Term Debt	6,150	6,141	6,822
Current and Accrued Liabilities	1,003	965	808
Reserve for Depreciation and Amortization of Utility Plant	3,327	3,065	2,096
Other Reserves	244	236	215
Deferred Credits	112	113	72
Contributions in Aid of Construction	46	46	47
Surplus	1,262	1,005	1,121
Total Liabilities	18,083	17,633	17,795

Source: Federal Power Commission.

End result on the industry's consolidated income statement was a slight drop, $7 million, in net income. It totalled $643 million compared to last year's high of $650 million.

The reduction in capital charges in 1947 brought them to the lowest point in more than 20 years. The total of $242 million compares with $277 million in 1926, when electricity output was less than one-third of what it was in 1947.

One development of significance for future capital operations appeared during the year. For the first time since 1932, interest yields on the industry's bonded debt began to go up. Some leveling off did appear in certain expense items, wages, for one.

Fuel costs, however, continued their disturbing upward trend. Electricity producers have felt the full impact of the rise in coal wages over the past several years. In 1947 alone prices of coal (or its equivalent in other fuels) jumped about 15 percent per ton.

The increase in per-ton costs of fuel was only one factor in raising the electric light and power industry's fuel costs. More fuel was used as over-all output of electricity increased. And shortages of water reduced the proportion of electricity produced by hydro plants.

These major cost advances resulted in a marked shift in the share of the revenue dollar going to various income and expense items. Fuel cost, for example, now make up 16.8 per cent of the revenue dollar—more than double the 7.7 per cent share they claimed in 1937. Altogether, the fast-increasing expense items have raised the ratio of operating expenses to revenue to a new high of 47.7 percent. They accounted for 42.5 percent of it in 1946 and for only 36.4 per cent ten years before.

Fixed charges on the other hand

have dropped from 15.4 per cent of the revenue dollar in 1937 to 6.7 per cent now. And the proportion flowing to dividends and surplus has fallen from 23.7 per cent ten years ago to 17.9 per cent now.

The consolidated balance sheet shown in this section also reveals certain trends of importance. The importance of depreciation funds as a means of financing the growth of the industry is one of these. From 1941, through 1946, total reserves for depreciation and amortization increased $1,231 million. During the same period, the value of electric plant and equipment increased $1,351 million. Detailed analysis of these changes in the consolidated balance sheet is impossible, however, because of the continuing revaluation of assets undertaken at the direction of the Federal Power Commission. It appears likely, though, that expansion of facilities up to 1947 had been financed substantially by reinvestment of depreciation funds, and of undistributed earnings.

Sales of securities for the industry bear out this conclusion, but the figures for 1947 show a significant change. In the years 1942 through 1945, for example, new capital issues totaled only $157 million, a fraction of the increase in the value of plant and equipment in that period. In 1946, similarly, the industry raised new capital totaling only a little more than half of the amount it charged to depreciation that year.

But in 1947 a total of $537,729,000 of new capital issues reached the market—more than three times the 1946 total of $173 million. Depreciation charges increased slightly from 1946 to 1947, but the total of $336 million is only about 60 per cent of the total of new capital issues.

Refunding continued at a high level in 1947. The total of $1,010 million was higher than 1946's $910 million, but substantially under the record set in 1945. It reduced capital costs, but was offset to some extent by an upturn in average yields. The average yield of 59 new issues of mortgage bonds was 2.78 per cent, compared to an average yield in 1946 of 2.61. The average yield of 33 new issues of preferred rose to 4.04 per cent from 3.56 in 1946.

SECURITY SALES BY CLASSES

(In Thousands of Dollars)

Year	Bonds, Debentures, etc., to		Stocks, Common and Pfd.	Total Financing	Distribution of Security Sales		
	Public Investors	Institutional Investors			New Capital	Refunding	Total Issues
1933	53,725	Included	2,523	56,248	6,813	46,913	53,725
1934	131,175	in Col. 1	.....	131,175	2,431	128,744	131,175
1935	957,042	110,629	8,229	1,075,900	26,496	1,049,404	1,075,900
1936	1,122,800	156,881	52,259	1,331,940	59,727	1,272,213	1,331,940
1937	522,613	37,604	86,095	646,312	81,984	563,699	645,682
1938	750,549	192,762	20,694	964,005	123,056	840,949	964,005
1939	620,205	252,625	123,517	996,347	16,219	980,128	996,347
1940	660,716	188,976	139,767	989,459	92,376	897,083	989,459
1941	368,712	255,912	116,208	740,832	97,065	643,767	740,832
1942	226,800	99,688	29,766	356,254	92,666	263,588	356,254
1943	329,300	26,850	14,912	371,062	9,921	361,141	371,062
1944	851,743	103,950	62,535	1,018,228	15,587	1,002,641	1,018,228
1945	1,113,603	121,051	127,268	1,361,922	39,699	1,322,253	1,361,922
1946	633,966	64,040	384,441	1,082,447	172,846	909,601	1,082,447
1947	1,009,517	153,159	384,699	1,547,375	537,729	1,009,646	1,547,375

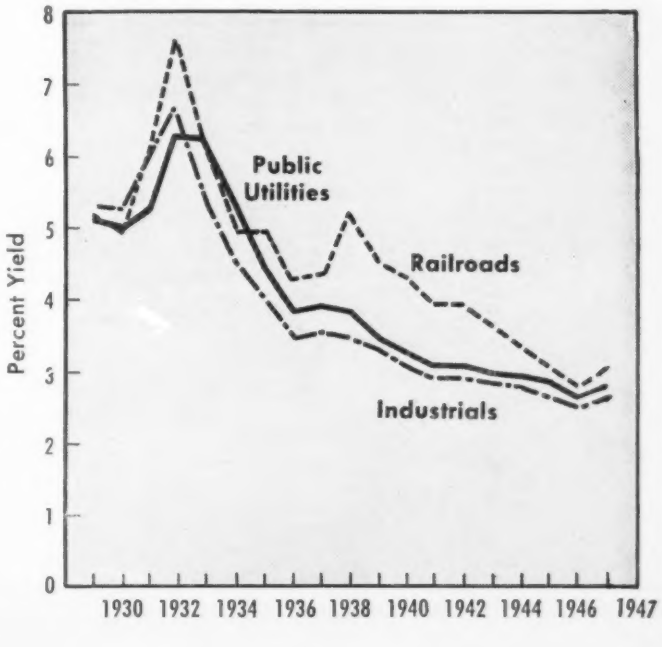
DISTRIBUTION OF REVENUE DOLLAR

(Percentage)

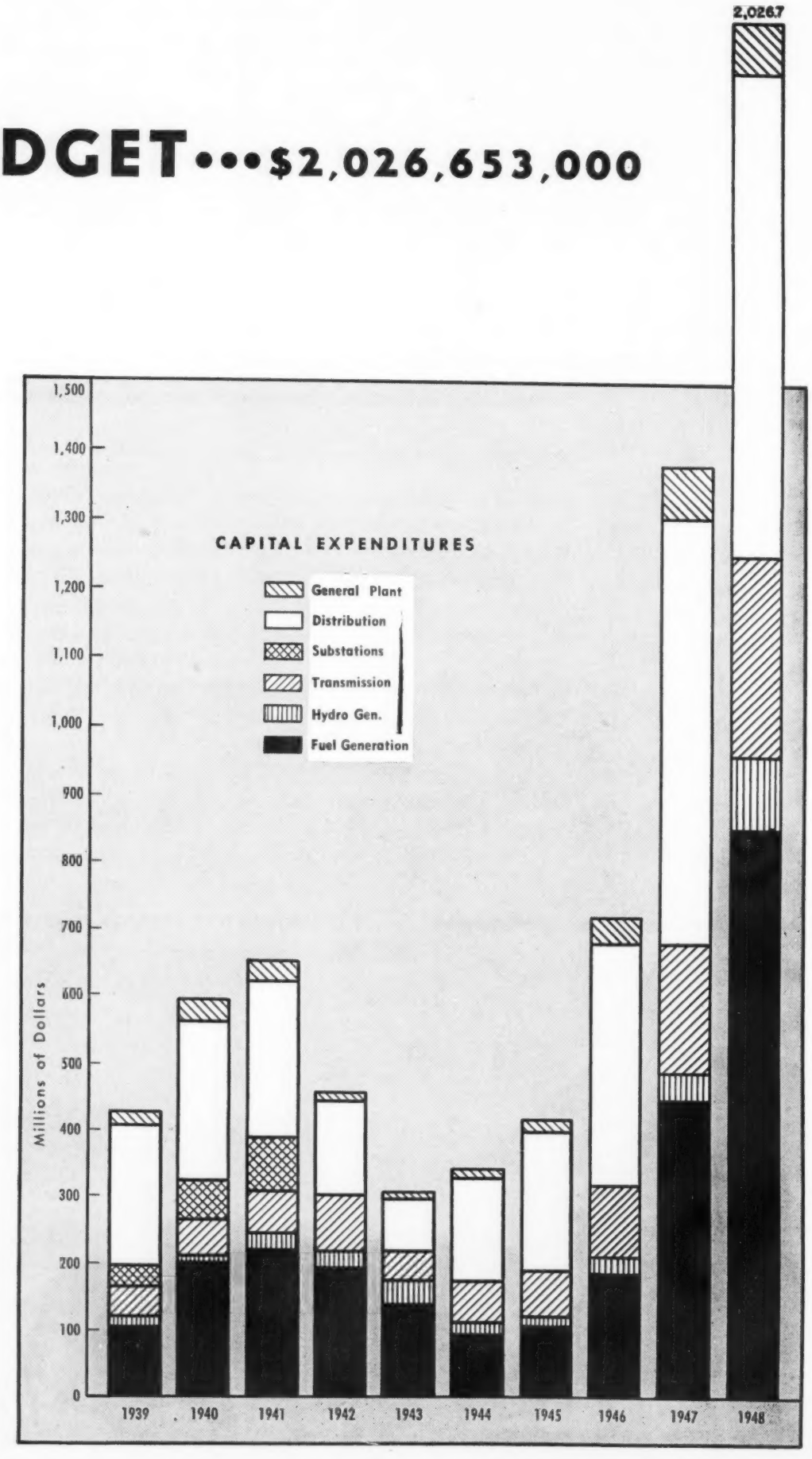
	1937	1941	1946	1947*
Fuel	7.7	9.6	13.1	16.8
Salaries and Wages	17.6	16.1	18.5	19.8
Other Operating Expenses	11.1	10.8	10.9	11.1
Depreciation	10.1	10.8	9.9	9.4
Fixed Charges	15.4	12.0	8.0	6.7
Taxes	14.4	20.0	19.6	18.3
Dividends and Surplus	23.7	20.7	20.0	17.9
	100.0	100.0	100.0	100.0

*Estimated.
Source: Federal Power Commission and Edison Electric Institute.

COMPARATIVE AVERAGE BOND YIELDS



BUDGET•••$2,026,653,000



THE OVER $2 billion estimated for electric utility construction in 1948 will probably not remain the record high for the industry for more than a year. Present indications are that it will be topped in 1949, just as it exceeds the previous high of $1.4 billion for 1947.

Of the expenditure planned for 1948, nearly half, 48 percent, will be used for construction of generating plant, an obvious necessity, considering the present narrow margin of reserve capacity. About one third will be laid out for distribution.

A considerable part of the budget increase of 1948 over 1947 results from rising costs. This was the case also in respect to the increase of 1947 over 1946. It was estimated that the overall cost rise from pre-war boosting the 1947 budget was 30 percent. Now, according to information collected by Electrical World's latest survey of construction and capital expenditures, the boost has risen to 53 percent.

Ranges of Cost Increase

These ratios of cost increase can be taken only as indicative, not as exact. They are the means of wide ranges of estimate. For instance, in respect of fuel power plants the range is from a low of 30 percent increase to a high of 175 percent. For hydro plants the range is from 40 to 150 percent; for transmission, from 25 to 160; for distribution also from 25 to 160. Also to be considered is the fact that only a comparatively few utilities replied to the question. For what they are worth, therefore, here are the calculated averages of cost increases in the different groups of electric system construction: fuel power plants, 54 percent; hydro plants, 65 percent; transmission, 48 percent; distribution, 53 percent; miscellaneous, 54 percent; total plant, 53 percent.

The money figures presented here are, however, as valid as can be derived from any survey of future plans. They were compiled from information supplied by well over 200 operating utilities, representing over 80 percent of the industry in terms of both installed capacity and customers served. Indicative of the effort to achieve maximum use of capacity are the increasing expenditures for transmission, rising from $106 million in 1946 to an estimated $286 million in 1948.

ANNUAL CAPITAL EXPENDITURES FOR NEW CONSTRUCTION

Electric Light and Power Industry

(In Thousands of Dollars)

Year	Fuel	Hydro	Transmission	Distribution	General Plant	Total
1933	10,400	4,000	16,100	72,200	11,700	129,300
1934	10,258	5,704	30,180	76,299	13,292	147,654
1935	16,172	6,337	35,349	103,104	17,127	192,855
1936	36,820	9,030	20,170	174,640	24,000	289,710
1937	113,060	10,540	40,740	203,250	38,600	455,480
1938	133,000	17,600	36,000	215,000	34,000	482,000
1939	101,500	17,900	45,500	210,500	22,850	430,000
1940	200,430	9,270	55,900	237,700	35,520	596,580
1941	219,741	27,186	62,476	232,840	32,687	654,148
1942†	191,671	22,847	85,633	144,180	11,644	455,975
1943	137,059	35,505	42,923	84,683	6,066	306,286
1944	96,126	19,888	61,196	151,969	11,105	340,284
1945	106,166	12,713	68,935	204,492	16,623	408,929
1946	190,955	18,974	106,550	360,980	40,710	718,169
1947	440,547	40,901	195,074	624,038	71,585	1,372,145
1948‡	855,681	104,432	286,465	684,858	95,217	2,026 653

† Expenditure study not made by "Electrical World" in 1942. Figures are those reported by Federal Power Commission for privately owned utilities only.
‡ Prospective.

CONSTRUCTION EXPENDITURES*

As reported to Electrical World

(Thousands of Dollars)

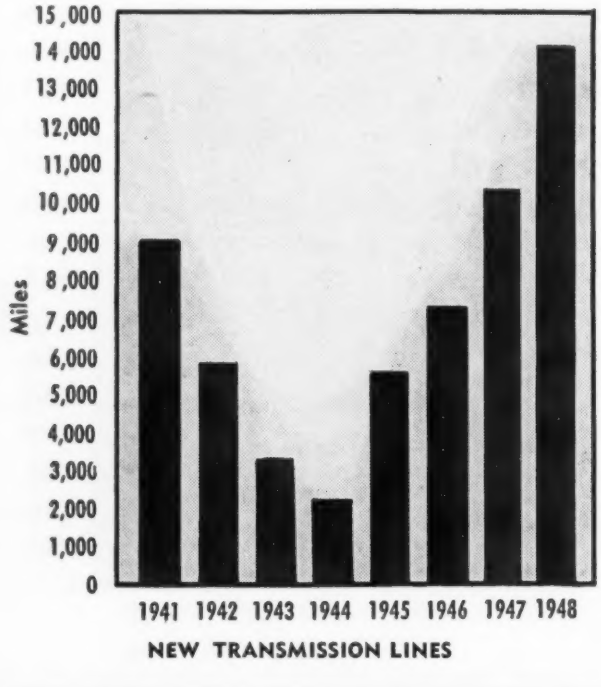
Regions	Fuel	Hydro	Transmission	Distribution	General Plant	Total
Estimated—1947						
United States	$440,547	$40,901	$195,074	$624,038	$71,585	$1,372,145
New England	32,906	4,140	7,572	36,493	6,129	87,240
Middle Atlantic	112,037	953	39,262	99,216	12,503	263,971
E. North Central	94,329	334	37,409	125,454	18,521	276,047
W. North Central	59,401	396	23,226	45,371	6,783	135,177
South Atlantic	38,503	413	13,329	94,541	8,440	155,226
E. South Central	13,211	144	6,398	27,790	2,169	49,712
W. South Central	36,435	33	23,701	63,285	6,798	130,252
Mountain	14,205	12,731	5,206	22,083	1,610	55,835
Pacific	39,520	21,757	38,971	109,805	8,632	218,685
Prospective—1948						
United States	855,681	104,432	286,465	684,858	95,217	2,026,653
New England	49,759	13,240	14,792	44,986	8,010	130,787
Middle Atlantic	161,173	5,675	48,430	115,171	12,297	342,746
E. North Central	238,700	2,149	67,116	146,412	23,819	478,196
W. North Central	131,350	2,109	37,779	53,430	11,379	236,047
South Atlantic	95,700	1,644	26,715	99,299	14,802	238,160
E. South Central	22,029	443	6,490	26,465	1,514	56,941
W. South Central	62,236	79	29,379	65,394	9,996	167,084
Mountain	22,128	22,352	8,735	18,551	2,570	74,336
Pacific	72,606	56,741	47,029	115,150	10,830	302,356

* Covers Power Companies, State Authorities and Municipal Plants. Excludes REA, TVA, Reclamation Bureau and other Federal Projects.

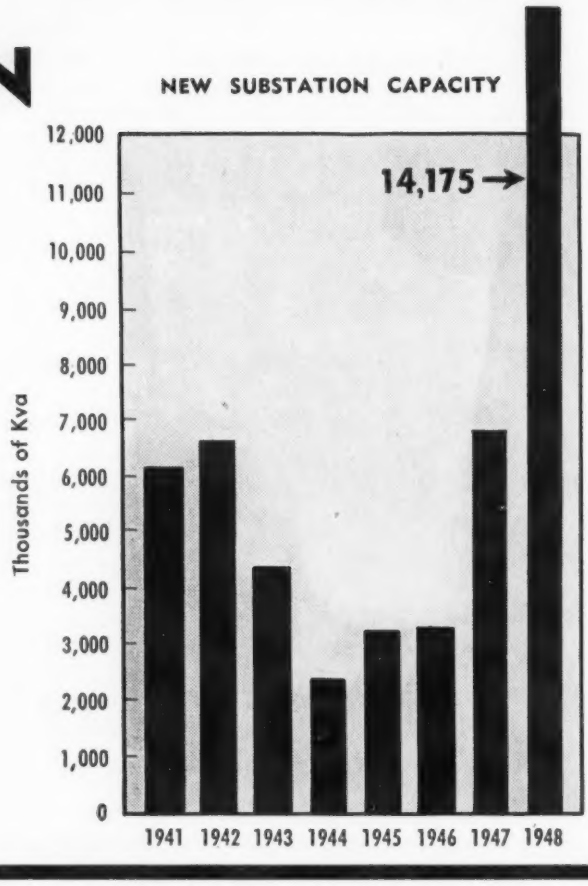
TRANSMISSION AND SUBSTATIONS

ONLY ABOUT TWO THIRDS of the additional substation capacity planned for 1947 was actually installed. Shortage of power transformers was undoubtedly the principal cause. And this raises the question whether the 14,715,000 kva projected for installation in 1948 is rather optimistic.

Transmission line construction also was less in 1947 than had been planned. And the same consideration of power transformer shortage raises the same question in regard to 1948 plans.



NEW TRANSMISSION LINES



CONSTRUCTION OF SUBSTATIONS

(In Thousands of Kva)

Region	1944	1945	1946	1947	1948*
New England	22	193	155	421	619
Middle Atlantic	221	199	320	1,259	2,446
E. N. Central	390	398	800	1,235	3,377
W. N. Central	72	207	160	491	1,577
South Atlantic	223	727	330	764	2,554
E. S. Central	377	518	260	349	411
W. S. Central	165	266	262	754	1,058
Mountain	18	215	32	266	368
Pacific	923	554	1,000	1,228	2,305
United States	2,411	3,277	3,319	6,767	14,715

Source: "Electrical World" Surveys. * Estimated.

CONSTRUCTION OF TRANSMISSION

(In Miles—11 Kv and Up)

Region	1944	1945	1946	1947	1948*
New England	34	74	259	210	384
Middle Atlantic	149	290	510	992	1,188
E. N. Central	248	677	750	1,060	2,239
W. N. Central	178	1,628	1,060	1,560	2,202
South Atlantic	378	357	1,230	1,902	3,261
E. S. Central	355	335	360	337	410
W. S. Central	389	921	730	1,733	1,772
Mountain	70	406	1,320	533	759
Pacific	413	980	1,115	1,913	1,890
United States	2,214	5,668	7,334	10,240	14,105

Source: "Electrical World" Surveys. * Estimated.

SUBSTATION CONSTRUCTION EXPENDITURES

(In Thousands of Dollars)

Region	1944	1945	1946	1947	1948*
New England	1,028	3,847	6,259	13,495	20,613
Middle Atlantic	6,957	5,162	7,960	25,902	44,225
E. N. Central	6,580	7,271	14,520	32,915	63,070
W. N. Central	3,575	4,345	3,330	13,059	23,179
South Atlantic	4,438	7,302	9,740	19,621	36,005
E. S. Central	1,461	1,378	3,250	6,379	8,655
W. S. Central	3,908	4,447	4,610	13,083	20,059
Mountain	1,196	2,223	1,785	4,870	7,934
Pacific	11,520	10,695	11,300	27,790	47,607
United States	40,663	46,670	62,754	157,114	271,347

Source: Electrical World Suveys. * Prospective.

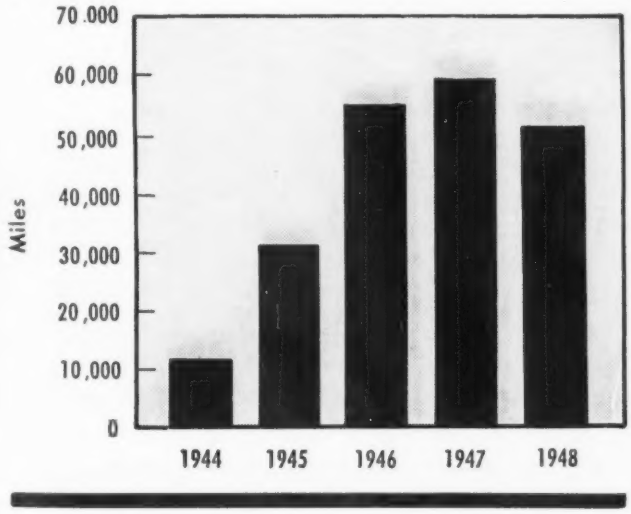
RURAL LINES

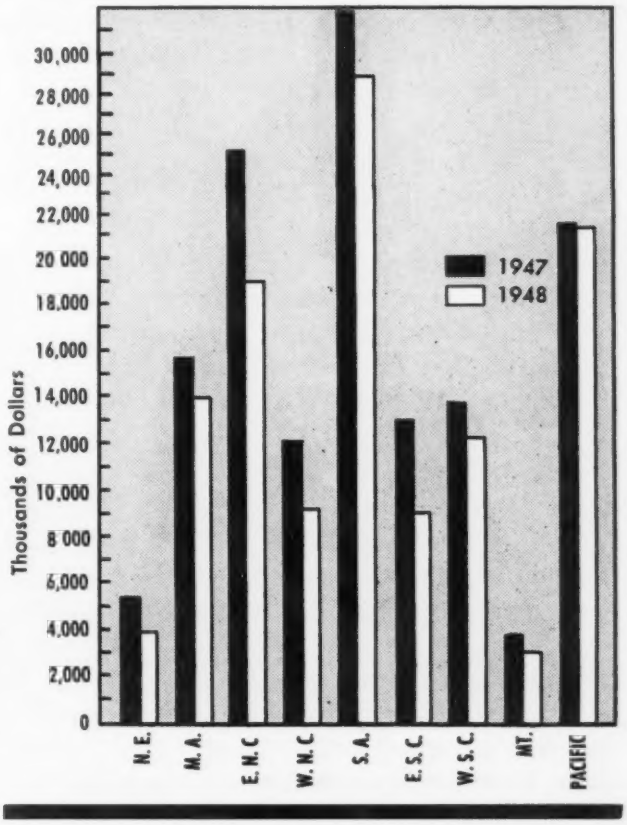
51,195 miles in 1948

EVIDENCE THAT THE JOB of building lines for rural service is approaching completion appears in the figures on this page. For the first time in 6 years mileage of lines planned for the coming year is less than was installed in the year before. In 1947 59,120 miles of line were built and plans for 1948 are for 51,195 miles. This large decrease, around 15 percent, is significant.

In every region of the country except one, the South Atlantic, mileage planned to be built in 1948 is less than was built in 1947.

Indicative of the increase in cost of rural line construction are the ratios of projected mileage to projected cost for 1947 and actual mileage to actual cost in the same year. This time last year it was planned to build 63,884 miles of line at a cost of $104,638,000. The ratio is $1640 per mile. Mileage built was 59,127 and the cost figure was $141,555,000. The ratio is $2400 per mile. These are not actual costs per mile. They are merely ratios between parallel sets of figures. They show a cost increase of about 50 percent which checks quite well with the average ratio of increase stated on another page.





MILES OF RURAL LINE EXTENSIONS*

Regions	1944	1945	1946	1947	1948†
New England	196	957	2,242	1,873	1,463
Middle Atlantic	3,160	4,876	6,220	6,138	5,050
E. N. Central	2,065	5,475	9,290	7,038	5,540
W. N. Central	1,724	2,744	3,860	5,653	4,978
South Atlantic	473	4,563	12,200	14,143	14,635
E. S. Central	301	3,894	5,720	6,377	4,230
W. S. Central	1,992	4,376	8,335	9,004	7,062
Mountain	180	2,075	3,550	2,254	1,939
Pacific	842	1,440	3,970	6,647	6,298
United States	10,933	30,900	55,387	59,127	51,195

Source: "Electrical World" Surveys.
* REA not included. † Estimated.

RURAL LINE CONSTRUCTION EXPENDITURES*

(In Thousands of Dollars)

Regions	1946	1947	1948†
New England	4,426	5,444	3,947
Middle Atlantic	12,990	15,471	13,926
E. N. Central	15,160	25,093	18,854
W. N. Central	5,410	11,972	9,135
South Atlantic	18,200	31,910	28,761
E. S. Central	8,670	12,763	8,902
W. S. Central	11,670	13,561	12,148
Mountain	4,280	3,938	2,855
Pacific	8,490	21,403	21,158
United States	89,296	141,555	119,686

Source: "Electrical World" Surveys.
* REA not included. † Estimated.

LABOR

Utility Employment and Wages

THE UPWARD MOVEMENT of wages and employment in the electric light and power industry began to level off in the second half of 1947.

Wages increased and employment expanded, but not as much as they had in 1945 and 1946. Average weekly hours in December were estimated at 42, compared to 41.4 in December, 1946, but they had declined from mid-year highs.

How the trend in wages is levelling is shown in average hourly earnings. They advanced to about $1.40 during the year—a gain of 6.3 cents an hour from December, 1946. But in 1946, they rose slightly more than 15 cents an hour.

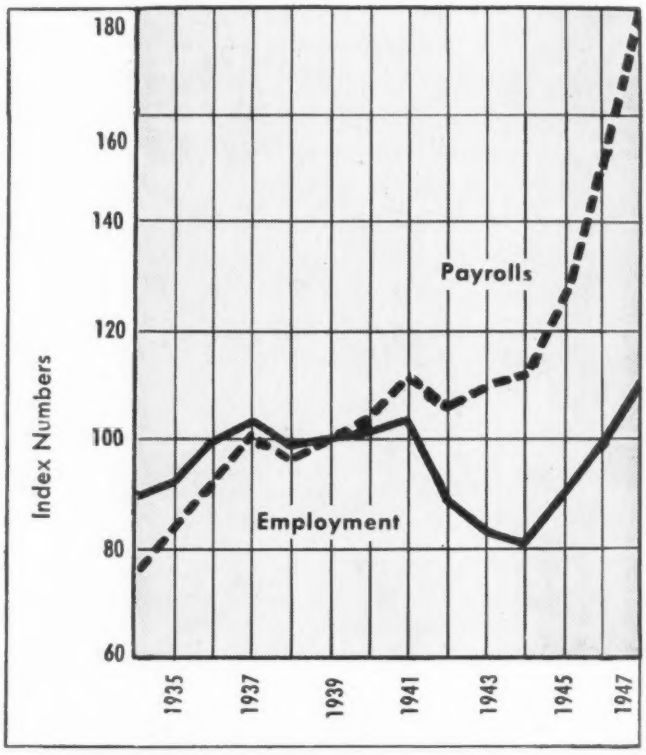
That the upward trend in employment is levelling, too, is shown in the index of employment. It reached 108.9 in August, declined slightly early in the fall, then moved up to an estimated 109 in December. As it increased, average weekly hours fell, from 42.4 in August to 42 at the end of the year.

The greater part of this advance, moreover, was recorded in the first half of the year. The contents of the average weekly pay envelope grew by $3.26 between December, 1946, and mid-year. They continued to rise in the second half but more slowly, going up only another $1.16 before year's end.

Over the longer period, it is of interest to note that the combination of wage advances and continued long work weeks has put almost 70 percent more cash in the average workers' weekly pay envelope than it held in 1940. Weekly earnings averaged $35.37 then compared to $59 now.

How the electric light and power companies have been able to raise wages almost 70 percent since 1940 while electricity rates have been declining is revealed in the figures on power output. Employment has advanced only about 5 percent since 1941 while output has been doubled in recent years.

1947's leveling off in employment means that the industry has overcome its war-time loss of men to the services. From a peak of 256,000 workers in the privately-owned operating companies in 1941, employment fell to 200,000 at the end of 1944. Despite this loss, output increased nearly 40 percent to meet the demands of war. With employment now at 269,000—topping the 1941 peak for the first time since the war began—the industry has overcome the war-time deficiency and is fast staffing to meet the expanded post-war demands on it with maximum efficiency.



TREND OF PAYROLL AND EMPLOYMENT IN ELECTRIC UTILITIES

That the peak has not been reached, however, is shown in the continuing long work week. With hours still above the 40-hour normal, the industry can expect a still further advance in employment before getting back to normal working hours and normal efficiency. But from here on out, the expansion of the work force will be on a much more modest scale than in 1946 and 1947.

The extent to which payrolls have outstripped employment is charted on the opposite page. At the end of 1947, the employment index stood only 9 percent above its level in 1939. But payrolls had soared to 180 percent of their 1939 level. The

sharp difference in the two indices —considering the decline in rates —is perhaps the most dramatic way of expressing the electric light and power industry's ability to increase its output per worker.

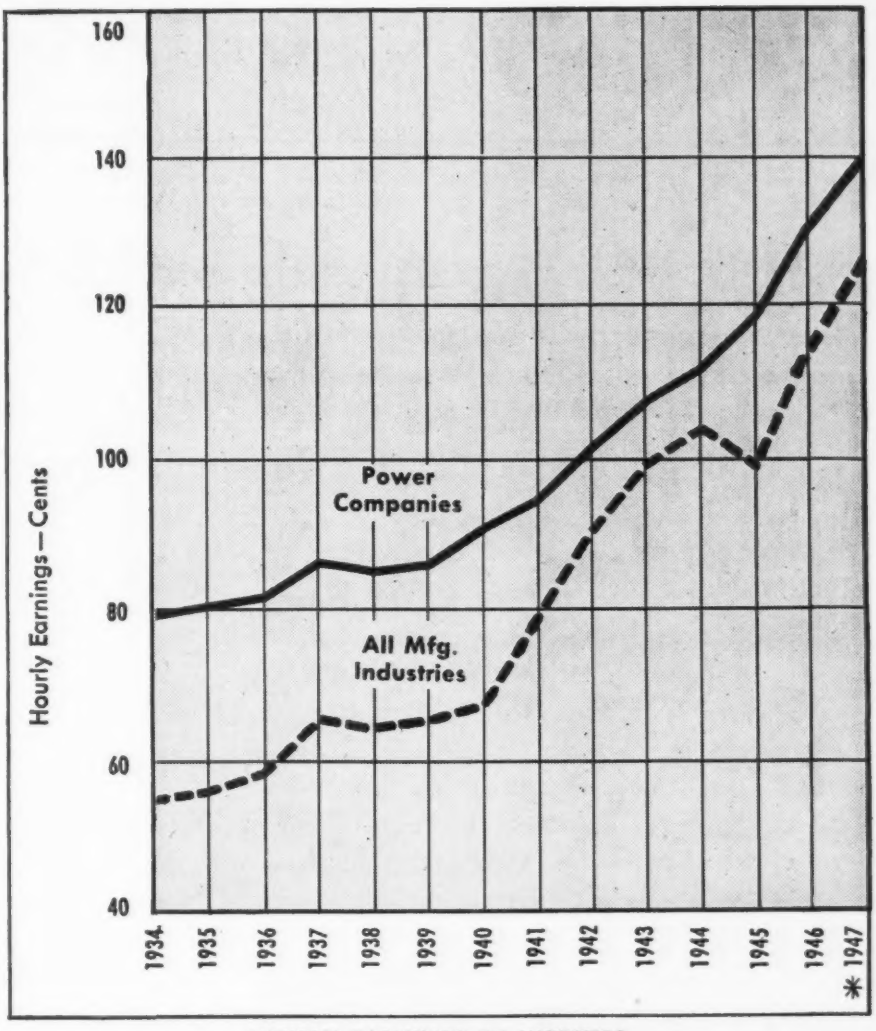
Measured by the amount of power produced per worker, the industry's output reached its peak in 1944. With its working force at its wartime low, the industry generated 1,154,000 kilowatt hours per employee—more than double the 1939 average of 528,000. As the industry rebuilt its staff in 1945, output-per-worker dipped to 1,000,000 kilowatts and then, in 1946, to 884,000.

Last year's surge in output raised the average again—to 985,000 kilowatt hours for each worker, an increase of more than 10%, although employment increased from 252,000 to 269,000.

Even though output per worker in 1947, was below the wartime peak, it was still more than double the 1937 average. Then the industry, with 255,000 workers, produced 478,000 kilowatt hours per employee. The increase permitted American industry's doubling production that decade.

The rise in electrical worker earnings parallels the rise in earnings of workers in the manufacturing industries. As a matter of fact, average hourly earnings of workers in manufacturing as a whole have advanced somewhat more sharply since 1940 than has been the case in the electric light and power industry. But manufacturing industries have accomplished such an increase only with the help of a tremendous upsurge of prices. Electrical workers have realized their gains at the same time the consumer has been benefitting from lower rates.

Moreover, the worker in electric light and power still earns more than his counterpart in manufacturing does. On a weekly basis, the $59 in the pay envelope of the electric light and power worker is some 10 percent more than the average worker in manufacturing receives.



HOURLY EARNINGS OF WORKERS

WAGES AND EMPLOYMENT IN ELECTRIC LIGHT AND POWER COMPANIES

(December of each year)

Dec.	Aver. Hourly Earnings (in cents)	Aver. Weekly Earnings (in dollars)	Est. No. of Employees (thousands)	Aver. Weekly Hours	Index of Employment Dec. 1939 = 100	Index of Payrolls Dec. 1939 = 100
1933	72.2	29.06	219	39.9	88.5	72.2
1934	79.1	30.35	220	38.5	89.0	76.1
1935	80.5	32.10	229	40.0	92.6	84.1
1936	81.9	33.00	246	40.7	99.7	92.1
1937	87.3	34.94	255	40.1	103.1	101.2
1938	86.1	34.33	243	40.0	98.2	97.1
1939	87.1	34.64	247	39.7	100.0	100.0
1940	90.4	35.37	250	39.1	101.3	103.5
1941	94.0	37.73	256	40.3	103.4	112.5
1942	102.2	41.94	221	40.8	89.3	107.3
1943	107.8	46.48	205	42.9	83.1	109.7
1944	111.9	48.84	200	43.3	81.0	112.4
1945	118.6	50.49	222	42.0	89.6	127.3
1946	133.7	54.58	252	42.0	101.8	158.4
1947*	140.0	59.00	269	42.0	109.0	180.0

* 1947 is an estimate by Electrical World on basis of September data from Bureau of Labor Statistics.
Source: Bureau of Labor Statistics.

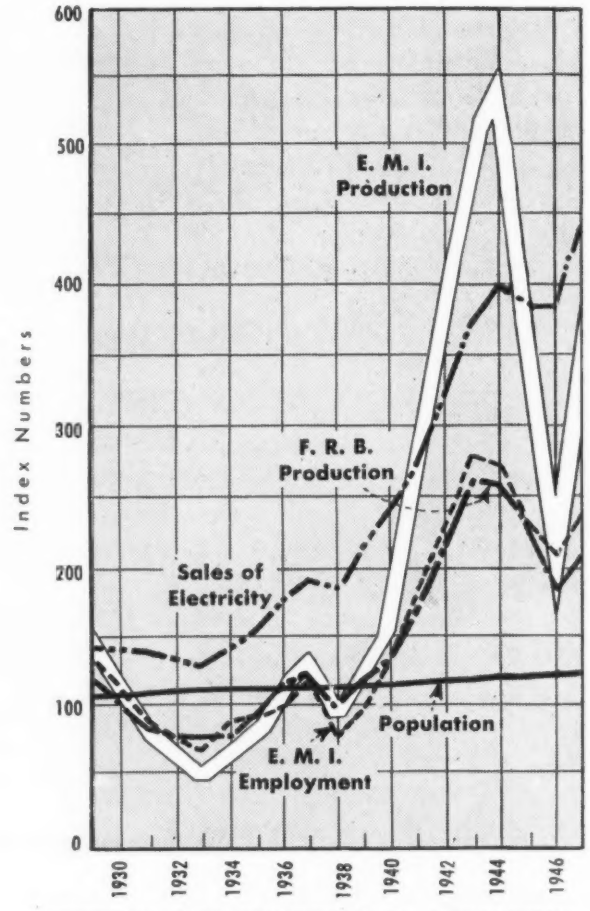
MANUFACTURING

ALL INDEXES of electrical manufacturing activity in 1947 show increases over 1946. All the increases are large, one spectacularly so. This is in the index of appliance production, which more than doubles the 1946 figure. Ratio-wise, the increase in this index is small compared with that of 1946 over 1945. But 1946 was the first full year of production after four war years during which practically no appliances were produced for the civilian market and few for the military.

It is to be noted in the tabulated data that the index of refrigeration production is discontinued after 1945. From then it is included in the general classification of electric appliances. Because of the seasonal character of its production, refrigeration is presented separately in the monthly indexes compiled by the National Electrical Manufacturers Association. In setting up the annual indexes presented here, it was natural that the pattern of the monthly figures should be followed, as was done through 1945. But seasonal variation has no effect on an annual index and thus there is no reason why refrigeration should not be combined with other appliances in an inclusive index.

Another difference between the production indexes here presented and those previously published is the elimination of the dollar base figures for the indexes. These dollar figures did not represent the dollar values of productions for the whole industry in the several index categories, but only the values of productions of the sample groups of manufacturers and products on which each index was based. Of recent years the picture has been further confused by the fact that until 1947 there had been no Census of Manufacturers since 1939. Next year, with the 1947 Census data furnishing current benchmarks, all figures of electrical manufacturing activity will be capable of more accurate determination.

After their declines in 1945 and 1946 from the peaks of war production, the trends in EMI (Electrical Manufacturing Industry) production and employment turned up in 1947, the former quite



ELECTRICAL MANUFACTURING IN COMPARISON

sharply from 258 to 384. No such sharp upturn was made by the FRB index of production which moved from 187 to 208. From this difference in trend behaviors it is to be concluded that electrical manufacturing is far ahead of the average of all industry in swinging into post-war pace.

New construction by electric utilities for 1948 is budgeted at close to $2 billion. Preliminary estimates put the total of capacity additions in the coming year at over 4 million kw. As of December 1, 1947, manufacturers had orders for nearly 18 million kw of generating capacity. Thus it appears that the indicated 1948 rate of expansion of electric utility systems will continue through 1951. Thus it seems to be a very safe bet that electrical manufacturing will remain at its present high level of production for some years to come.

1947 Appliance Production Doubles 1946

THE INDUSTRY AND RELATED FACTORS

(Index Numbers 1925 = 100)

	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947*
1. E. M. I. production	137	97	123	154	276	415	522	553	390	258	384
2. E. M. I. employment	117	80	98	129	189	228	282	271	228	210	238
3. F. R. B. production	124	97	120	137	178	219	263	258	223	187	208
4. Sales of electricity	199	187	212	238	281	319	372	396	387	382	437
5. Population	113	113	114	115	116	117	119	120	122	123	126

Source: NEMA. *Estimated.

1. "E.M.I. PRODUCTION Indexes are based upon data compiled by the Bureau of the Census and the NEMA Statistical Department. The indexes reflect total production in the electrical manufacturing industry, which industry is considered to cover not only those products commonly referred to as Electrical Machinery, Apparatus and Supplies, but also all electric appliances including washing machines, vacuum cleaners, household refrigeration equipment, commercial refrigeration equipment, air conditioning equipment, lighting fixtures, insulating materials, radio apparatus and supplies, automotive electrical equipment, steam turbines for electrical drive, bare copper wire, and mining and industrial electric locomotives. Production of non-electrical equipment within the industry is also included for the war and post-war years."

2. E.M.I. EMPLOYMENT based on labor series of National Industrial Conference Board, but adjusted to 1925 = 100. This series represents the electrical manufacturing industry including radio and includes latest revision to Census figures made by N.I.C.B.

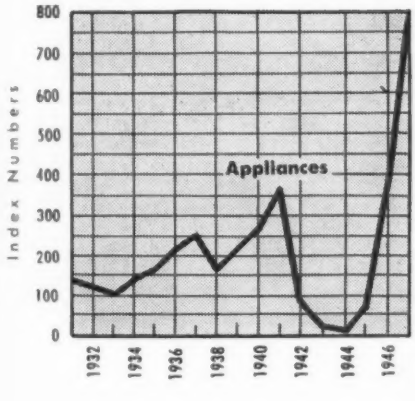
3. F.R.B. PRODUCTION based on the Federal Reserve Board's revised index for total industrial production, unadjusted, and adjusted to 1925 = 100. (Includes all revisions made by Federal Reserve Board up to December 15, 1943.)

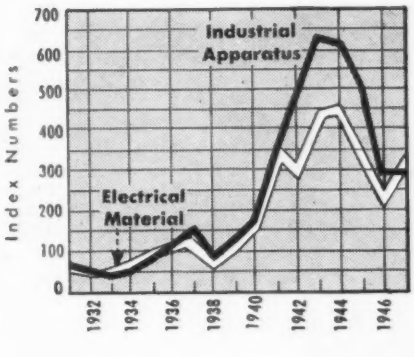
4. ELECTRIC POWER SALES index figures based upon Edison Electric Institute data.

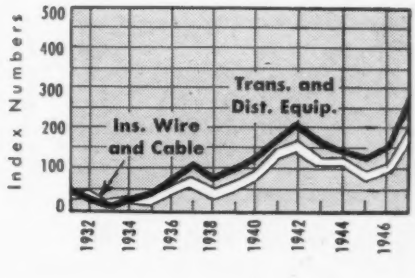
5. POPULATION based upon the annual mid-year estimates of the U. S. Bureau of the Census.

MANUFACTURER'S SALES

(Index Numbers: 1925=100)







MAJOR BRANCHES OF ELECTRICAL MANUFACTURING INDUSTRY

(Index Numbers 1925 = 100)

Manufacturers' Sales	1937	1938	1939	1940	1941	1942	1943	1944	1945	1946	1947†
1. Appliances	136	109	128	151	212	73	12	16	62	395	795
2. Refrigeration	1,360	769	1,100	1,331	1,800	264	158	25	170	*	*
3. Electrical material	131	83	116	149	253	318	447	453	343	253	348
4. Industrial apparatus	161	97	127	177	317	465	638	633	455	295	409
5. Trans. and dist. equipment	124	90	104	124	189	213	167	141	138	153	270
6. Insulated wire and cable	98	60	71	87	157	155	135	121	100	124	201

Source: NEMA. *Refrigeration discontinued as a separate index in 1946; thereafter included with appliances. For parallel continuity with others, the appliances index has been revised to include refrigeration back to 1925, as follows: 1925–100; '27–139; '29–178; '31–145; '33–111; '34–143; '35–170; '36–226; '37–262; '38–177; '39–229; '40–273; '41–376; '42–93; '43–27; '44–17; '45–73.

† Estimated

1. APPLIANCES include domestic kitchen and table appliances, electric ranges, electric water heaters, electric vacuum cleaners, electric washing machines, electric fans and food service equipment.

2. HOUSEHOLD REFRIGERATION includes complete units, parts and cabinets. Commercial refrigeration equipment and air-conditioning equipment are excluded.

3. ELECTRICAL MATERIAL includes carbon, electrical porcelain, laminated phenolic products, manufactured electrical mica and vulcanized fiber. Molded insulation is excluded.

4. INDUSTRIAL APPARATUS includes electric welding equipment and wire, industrial controls, industrial heating equipment and motors and generators (excluding all generators except motor-generator sets). Electric furnaces and electric tools are excluded.

5. TRANSMISSION AND DISTRIBUTION EQUIPMENT includes switchgear, high-voltage insulators, power and distribution transformers, lightning arresters pole line hardware and earth anchors, panelboards and distribution boards, small air circuit breakers and watthour and demand meters.

6. INSULATED WIRE AND CABLE for light and power includes only the following types: weatherproof wire, paper-insulated power cable, varnished cambric cable, rubber-sheathed cord and cable and rubber-covered building wire.

All indices based upon U. S. Census of Manufacturers data and NEMA statistical department data corrected where possible to represent the entire industry.

REA . . . Costs Are Rising

FOR the first time, operations data of REA cooperatives reported on this page are directly comparable from one year to the next. The series was started in the 1942 Annual Statistical Number, but until now the data were not comparable because at first the records covered fiscal and calendar years and war loads later distorted the rural service picture.

Item	Calendar Year 1945	Calendar Year 1946	Calendar Year 1947 [1]
Cumulative Year-End Data			
Total Loan Allocations	$666,954,331	$958,009,090	$1,192,000,000
Distribution Lines	$593,229,377	$848,823,996	$1,049,000,000
Generation and Transmission	$61,430,591	$96,021,231	$129,500,000
Consumer Facilities	$12,294,363	$13,163,863	$13,500,000
Funds Advanced	$463,541,933	$595,730,269	$821,000,000
Systems in Operation	848	869	904
Miles of Line in Operation	449,579	506,838	594,000
Consumers Connected	1,408,918	1,683,901	2,030,000
Systems Generating Power	75	79	77
Generating Plants—Kw Capacity	95,846	114,678	183,935
Annual Data			
Energy Generated—Kw.-Hr.	258,396,817	319,913,275	394,000,000
Energy Purchased—Kw.-Hr.	2,344,549,783	2,730,264,776	3,695,000,000
Total System Input—Kw.-Hr.	2,602,946,600	3,050,178,051	4,089,000,000
Energy Sold—Kw.-Hr.	2,136,384,023	2,477,508,980	3,332,000,000
Operating Revenues	$73,102,430[3]	$89,089,822[5]	$113,600,000
Cost of Power[2]	$22,177,972	$26,669,422	$36,200,000
Distribution Expenses—Operations	$4,600,932	$6,807,058	$8,610,000
Distribution Expenses—Maintenance	$3,018,361	$4,049,128	$6,010,000
Consumers Accounting & Collecting	$2,551,920	$3,368,477	$4,300,000
All Other Operating Expenses	$9,652,278	$12,687,552	$15,540,000
Total Operating Expenses	$42,001,463	$53,581,637	$70,660,000
Net Non-Operating Margin	$620,548	$750,106	$900,000
Interest Expenses	$7,507,266	$8,675,204	$12,150,000
Net Revenue Before Depreciation	$24,189,985[4]	$27,524,120[6]	$31,690,000
Depreciation	$12,739,254	$14,670,782	$17,880,000
Net Margin After Depreciation	$11,450,731	$12,853,338	$13,810,000
Payments to Government Cumulative Data			
Interest Due	$49,442,566	$59,046,662	$68,000,000
Interest Paid	$48,896,243	$58,369,373	$67,300,000
Principal Due	$36,054,846	$48,039,048	$65,500,000
Principal Paid	$55,812,174	$67,729,229	$84,700,000
Overdue Amounts—More than 30 days	$632,946	$892,941	$950,000
a. Interest	$464,378	$612,796	$550,000
b. Principal	$168,568	$280,145	$400,000
Advance Payments of Principal	$19,975,527	$20,052,590	$19,800,000

Source of Data: Monthly Operating Reports of REA Borrowers and records of the REA.
[1] Based on ten (10) months actual data and one (1) to three (3) months estimated.
[2] Cost of Power includes cost of purchased power and prime costs involved in the production and transmission of generated energy.
[3] Does not include revenues of $504,853 reported by 15 REA Borrowers from whom figures for other items were not available.
[4] After deducting miscellaneous revenue deductions of $24,264 not shown separately.
[5] Does not include revenues of $857,723 reported by 14 REA Borrowers from whom figures fo other items were not available.
[6] After deducting miscellaneous revenue deductions of $58,967 not shown separately.

For the three years the costs of input energy were 8.91, 8.74 and 8.85 mills per kwhr in that order. Revenues per kwhr were 3.75, 3.60 and 3.41 cents. The average consumer bills were $54.62, $57.61 and $61.18 while average energy usage per consumer rose from 1,456 to 1,602 and 1,794 kwhr.

With costs increasing all along the line and with unit revenues declining as the average consumer uses more energy, the three-year period shows a significant rise in operating ratio, 56.8, 60.1 and 62.2 percent.

The allocations estimate of miles of line as December 31, 1947, is 863,000 miles. Dividing this into the 1947 total loan allocations shown in the table, results in a cost of $1,381 per mile. This is a large increase over the $1,137, published last year for 1946.

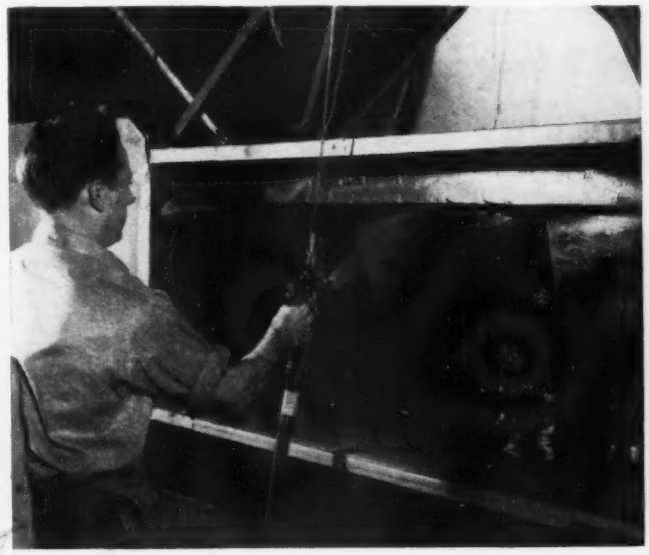
The rise in costs is reflected also in the figure of cost per consumer of $452 for 1947. That cost was $408 for 1946. The allocations estimate of consumers at the end of 1947 is 2,635,000.

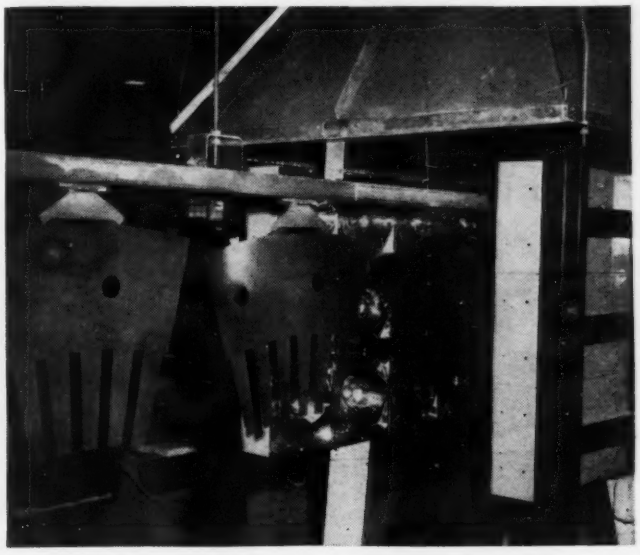
The annual records here tabulated are what can be considered to be a presentation of normal operations of REA systems. The data for 1945 have been adjusted to exclude the Ark-La Electric Cooperative, the last of the definitely war-time operations of REA.

HOW

DESIGN • CONSTRUCT • OPERATE • MAINTAIN

Generator Laminations Reinsulated in the Field





SPRAYING LAMINATIONS with red oxide glyptal without removing original varnish (left). Rotation of 180 deg at center of booth allows both sides to be sprayed in one operation. Infrared lamps cut drying time from three hours at 110 C in a conventional oven to about three minutes at 150 C (right). Speed of conveyor is controlled by Ward-Leonard system on d-c driving motor

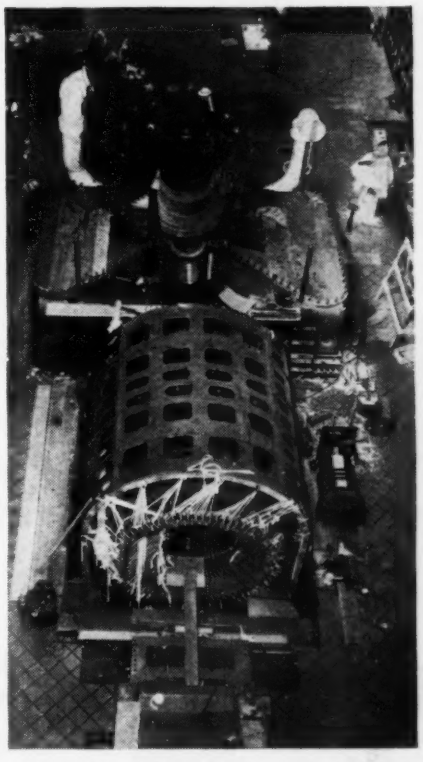
FRANK R. GOULD
Superintendent of Maintenance
Repair and Shops Sections
Department of Water and Power
Los Angeles, Cal.

IRON FAILURE in the stator of a 37,500-kva generator early last year brought the Los Angeles Department of Water and Power face-to-face with the serious problem of repairing and returning it to service before the 1947-48 winter peak. One important outcome was development of a new and efficient field method for handling and reinsulating damaged stator laminations in large quantities.

Inspection showed that three of the twenty-four insulated through bolts holding the generator laminations were burned. Iron surrounding them was burned and bonded together so badly that it was necessary to dismantle the stator completely, remove the coils, and restack all the iron. When the manufacturer quoted 53 weeks shipment on new laminations, the company began experiments to reclaim the old ones.

Several methods were tried for putting a high-resistance varnish film on each lamination, while at the same time maintaining space so that the laminations could be reinstalled. Most satisfactory method was spraying. A mixture of one part red oxide glyptal to four and one-half parts of thinner was applied without removing the original varnish. This gave highest insulating resistance and a minimum build-up of varnish thickness. Extra build-up of the varnish was compensated for by reducing the sheets of insulating paper from 7-mils to a treated 2½-mil paper, spaced ½-in. throughout the stack of laminations. By turning ½-in. of metal off the clamping rings at each end of the stator it was possible to restack approximately 99 percent of the original laminations.

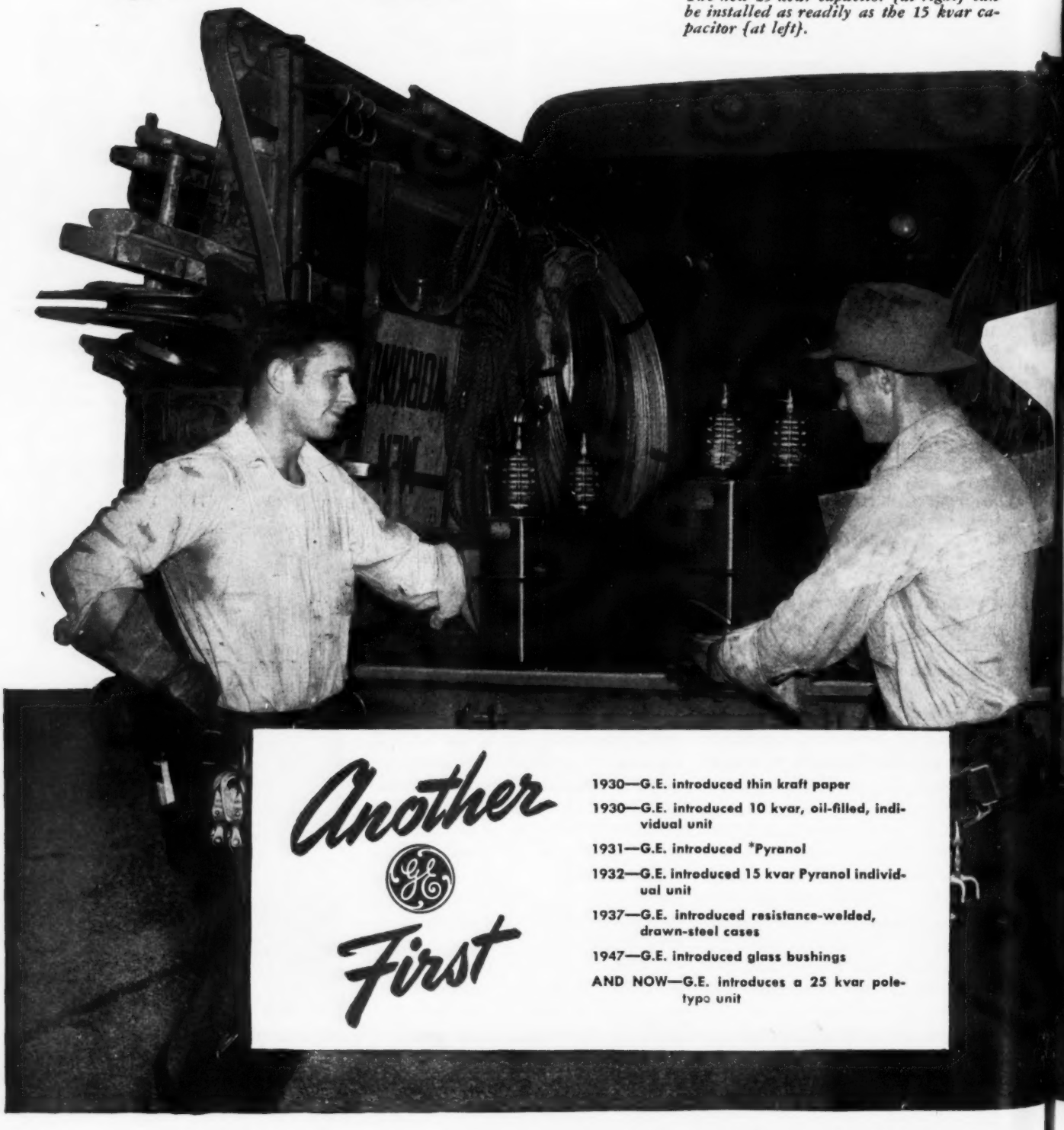
Toughest problem was the spraying of some 85,000 laminations in a reasonable length of time at reasonable cost. The solution was a continuous production line. It consisted of an endless carrier running through channels supported by an overhead



GENERATOR FAILURE affecting stator laminations forced shutdown of this 37,500 kva unit at Seal Beach plant of Los Angeles Department of Water and Power. It was repaired in four months and four days

25 KVAR IN

The new 25 kvar capacitor (at right) can be installed as readily as the 15 kvar capacitor (at left).



Another First

1930—G.E. introduced thin kraft paper

1930—G.E. introduced 10 kvar, oil-filled, individual unit

1931—G.E. introduced *Pyranol

1932—G.E. introduced 15 kvar Pyranol individual unit

1937—G.E. introduced resistance-welded, drawn-steel cases

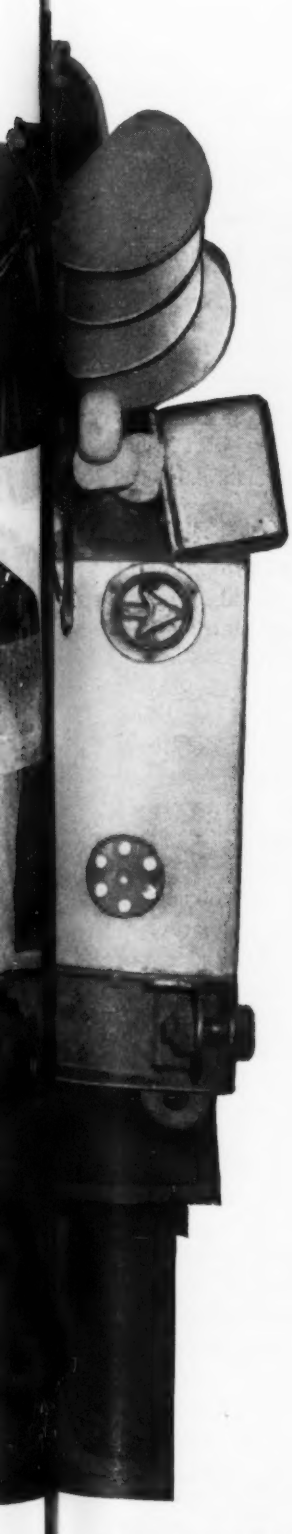
1947—G.E. introduced glass bushings

AND NOW—G.E. introduces a 25 kvar pole-type unit

ONE CAPACITOR UNIT

FOR POLE MOUNTING

General Electric announces a 25-kvar Pyranol capacitor that can be mounted in standard hangers



SMALL INCREASE IN SIZE OVER 15-KVAR UNIT These new capacitors, with 67 per cent more capacity, take approximately the same mounting space as 15-kvar units. Length remains the same. Width is increased only one inch. Height increase, including bushings, ranges from 2¼ inches to 4¾ depending on voltage.

FEWER CONNECTIONS, BUSHINGS, HANGERS PER KVAR Installation costs come down with these new capacitors, for up to 225 kvar can be mounted on a single crossarm—whereas 180 is the limit with 15-kvar units. Fewer units per kvar means fewer bushings, connections, and less exposed surface, cutting maintenance costs, too. Standard hangers (Cat. No. 13F20 for 3 units, Cat. No. 13F1 for 1) can be used.

GLASS BUSHINGS, WELDED TO CASE, MEAN MAXIMUM DEPENDABILITY The newly announced glass bushing is used in these new capacitors—assuring a strong, hermetic seal which is permanent.

SERVICE-PROVED DESIGN These Pyranol* distribution capacitors are similar in all respects, to the hundreds of thousands of 10- and 15-kvar units which have been installed on power circuits throughout the country. Cases are of drawn steel, with one resistance welded seam.

SHORT SHIPMENT SCHEDULE These new capacitors are now available. A General Electric specialist will be glad to discuss their application to your system and Bulletin GEA-2561-F-1 is available from *Apparatus Dept., General Electric Co., Schenectady 5, N. Y.*

CLASS ID—INDIVIDUAL POLE-TYPE UNITS—25-KVAR

For Nominal Circuit Voltage of	Capacitor Rating	Cat. No.	Net Wt. lb.	Approx. dimensions in inches		
				Length	Width	Over-all height (Incl. bushing)
2400 delta or 4160 gr-Y or ungr-Y.....	2400	13F138	70	13½	5 11/16	21⅛
4160 delta, gr-Y, or ungr-Y.....	4160	13F140	70	13½	5 11/16	21⅛
4800 delta or 8320 gr-Y.....	4800	13F148	71	13½	5 11/16	23 9/16
7200 delta or 12,470 gr-Y.....	7200	13F147	71	13½	5 11/16	23 9/16
7960 delta or 13,800 gr-Y.....	7960	13F141	72	13½	5 11/16	23 9/16

**Trade-mark Reg. U.S. Pat. Off.*

GENERAL ELECTRIC

407-124

monorail. Sprocket wheels carried the chain around each corner; power was supplied through gears and pulleys from a d-c motor with Ward-Leonard control.

Two men operated the production line. One hung the laminations on the carrier and removed them as they completed the circuit, the other operated the paint spray gun. Both sides of the laminations were painted from the same position, since the carrier automatically turned the lamination a half revolution when it reached the center of the spray booth. After spraying, the laminations passed through a tunnel of infrared lamps. These cut the drying time from three hours at 110 C in a conventional drying oven to three minutes at 150 C with infrared. Approximately 5,000 sheets were finished per 24-hour day. The entire job was completed seventeen days after the production line was started.

With such rapid progress it was apparent that the limiting factor on the job would be the generator coils, originally promised for 26 weeks shipment by the manufacturer. Since a large saving in fuel cost could be realized in these three months, a method of reconditioning the coils was developed. Final testing of all coils at 26,000 v (twice normal voltage) between coils and between coil and ground, in several instances showed up weaknesses which were missed by visual inspection.

• • •

Silicone Oils Designed For High Temperature Use

TABLE I—Summary of Chain Test Results

Lubricant	Failure Time in Days
Petroleum Oil A	36
Petroleum Oil B	34
Graphited Petroleum Lubricant C	23
DC 710R	more than 520, still running
DC 710G	more than 280, still running

TABLE II—Comparative Lubricity

Hardened Steel Ball Against	Wear in 0.0001 Gram Units SAE 20	DC 710R
Aluminum	65	300
Brass	4	3
Magnesium	10	4
Soft Steel	0	0
Hardened Steel Spring	2	3

THE DC 710 silicone fluids were developed as high-temperature lubricants useful at temperatures ranging from 10 to 500 F (—12 C to 260 C). These DC 710 fluids are also useful as high-temperature bath liquids and high-temperature hydraulic fluids, according to manufacturer's data.*

The basic DC 710 fluid, modified by the addition of a rust inhibitor, is available as DC 710R for lubricating and inhibiting the corrosion of instruments and machinery exposed to both high temperatures and moisture or weathering. For lubricating equipment operating at temperatures above 400 F (205 C), DC 710G containing colloidal graphite in suspension is recommended.

Both DC 710R and DC 710G are useful lubricants for all types of industrial machinery exposed to high humidity or weathering. DC 710R is used in substantial quantities as a lubricant for precision instruments exposed to either normal or high temperatures. DC 710G is designed for very high-temperature lubrication. It has a special affinity for metal, and spreads the graphite over the entire bearing surface. It eventually forms a tightly bonded and durable film having excellent lubricity.

* Portions of this article are reprinted with permission from the data sheet copyrighted by Dow Corning Corporation, Midland, Michigan.

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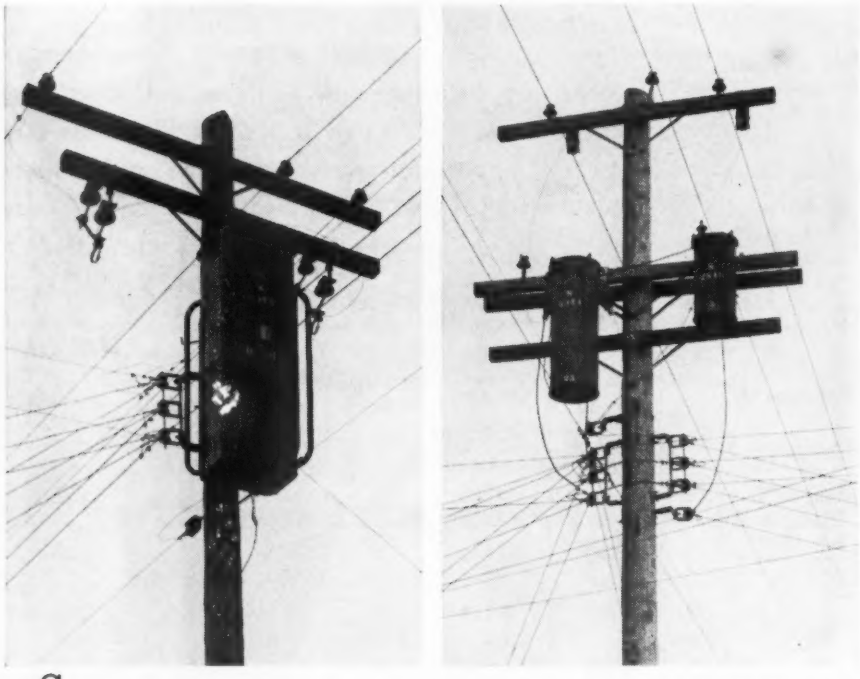
Two Transformers In One Case



SINGLE-CASE TWO-UNIT transformer replaces two single-phase transformers for supplying lighting and open delta three-phase power on four-wire secondary. Transformer was developed for the Washington Water Power Co, by the Line Material Co. Transformers of this type with various combinations of sizes, 37-1/2 and 10 kva; 25 and 5 kva, etc., have been used for several years by the utility in making distribution poles less conspicuous. As the photographs show, comparison with customary practice is striking. Cost of the single-case transformer is slightly more than that of two separately cased units of comparable size, but savings in crossarms, hardware, and labor make the single-case, throughbolt-mounted, unit the cheaper when installed

Comparative testing done by the manufacturer of these silicone oils indicates that they have about 10 times the lubricating life of high-temperature petroleum oils. In one test, motor-driven bicycle chains are constantly rotated through an oven at 350 F and then through a chamber at 100 percent relative humidity. The results of this comparative testing are given in Table I.

The lubricity of DC 710, as measured by its ability to reduce wear between various kinds of metal surfaces under light to moderate loads, is given in Table II. In these tests, a hardened steel ball under a 1,500-g load was made to slide back and forth at a fixed rate over each of the different metal strips for periods of 2 hr.

Typical properties of DC 710 are given in Table III.

TABLE III—Typical Properties of DC710 silicone Oil

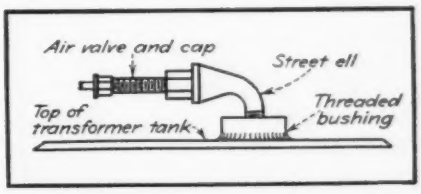
Property	Value
Freezing Point	—8 F (—22C)
Flash Point	610 F (320 C)
Viscosity, centistokes, 77 F (25 C)	480
212 F (100 C)	33
Viscosity, temperature coefficient $1-\frac{V\ 210\ F}{V\ 100\ F}$	0.86
Gelation Time, hours at 482 F (250 C)	1200-2000
Expansion Coefficient K x 1000/deg F, 77 to 212 F (25 to 100 C)	0.40
Refractive Index at 77 F (25 C)	1.52
Specific Gravity at 77 F (25 C)	1.10
Weight, lb per gal at 77 F (25 C)	9.18

• • •

Auto Air Valve Checks Transformer Tightness

W. W. LA BARR, Allis Chalmers Mfg Co, Los Angeles, Calif.

AN INEXPENSIVE, SIMPLE and effective way of assuring tightness of a subway transformer is through the use of a Schraeder (automobile tire) air valve welded to the tank cover. After the transformer has been connected, a small air pump is hooked up to the valve and the pressure raised to approximately 5 psi. The transformer is allowed to stand for an hour. If the pressure then has remained approximately constant, experience has proved that the transformer is sufficiently tight to give reliable service; even to the extent of operating at times completely submerged.



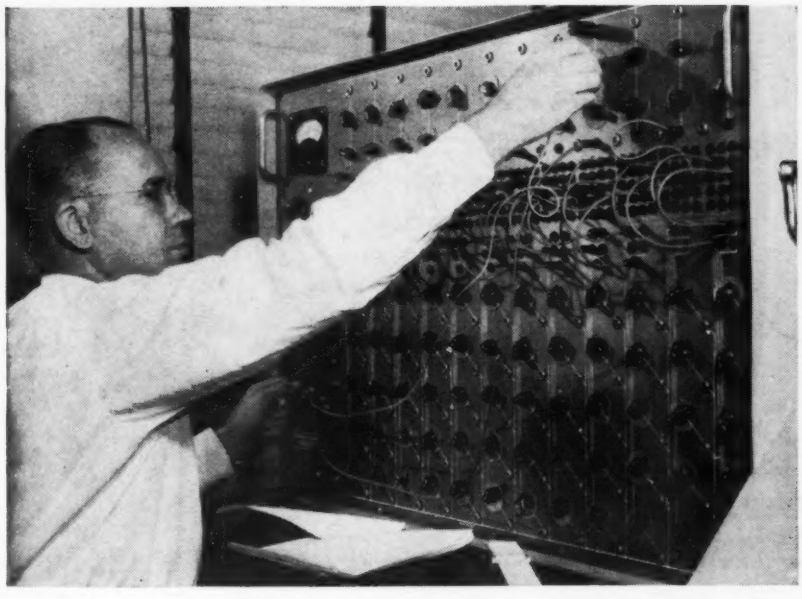
AIR VALVE is screwed into a ⅛-in. N.P.T. street ell which, in turn, is screwed into a threaded bushing. The latter is welded to the transformer top

Check for Leakage

Periodic checks of tank pressures for possible leakage are made by removing the valve cap and pressing the valve core pin. A hiss of escaping air assures the inspector that no leakage has occurred and that the transformer is mechanically tight. A transformer with no pressure remaining is immediately repumped and pressure gauge readings taken to find out if leakage is excessive. Transformers found to be leaking badly are replaced. Transformers tested by this unit have operated at times completely submerged.

• • •

Semi-Portable Calculator Solves Network Problems



CALCULATING BOARD of the type and size shown was designed to assist in determining currents and voltages in bank-secondary circuits supplied by CSPB transformers. It has been used also in solving problems on industrial-network systems. The board operates from a 120-v 60-cycle circuit, has provided accurate answers, and has saved many hours for the engineers of Westinghouse Electric Corp. In operating the board, circuits are set up to correspond to electrical constants of the actual system. Simulated transformers can be inserted at the proper points. Loads and short circuits are applied by inserting jumpers in plugs provided and turning the knobs to the proper positions. This simulates changing conditions on the actual system and quickly shows how the system will operate. At any point on the miniature system, the currents are read on built-in meters by plugging in test leads

Announcing...

SUPER

. . . now

SUPER CORONOL MEANS . . .

- • • G.E.'s rubber-type, high-voltage cable
- • • an answer to heat, ozone, and aging
- • • the advantages of 80-C operation

80-C OPERATION MEANS . . .

more power Super Coronol cables are the first high-voltage rubber types recommended for 80-degrees centigrade operation. This high copper temperature can be maintained even at 15000 volts. Result is higher current per conductor size, smaller diameter, more power for station cables.

lighter weight Extra current-carrying capacity cuts the weight of copper needed for a given load. More power per pound makes pre-assembled aerial cable more practical, easier to install.

longer life The same qualities that permit an 80-C copper temperature lengthen cable life. The insulation is specially compounded butyl rubber. It has a custom-built molecule. Absence of free carbon bonds greatly reduces action of heat, weather, ozone, and aging. Because Super Coronol gives extra service under harshest conditions, it's used on all General Electric mine-power cables.

Whatever the application—generator leads, aerial, or mine cable—you can now get real extras with Super Coronol. You get the handling and splicing ease of rubber plus high current-carrying capacity, excellent physical and electrical stability.

There are more data in our new bulletin, "Some Facts About Super Coronol." Just call your nearest Apparatus Department office, or write for GEA-1788, General Electric Company, Schenectady 5, New York.

IMPROVED STREET-LIGHTING PROTECTOR

The Type J-1 protector for series lighting circuits is easier to install, more positive and dependable in operation. All parts are more accessible. Protector is now single-bolt mounted. Time-lag adjustment is more sensitive and the sealed circuit breaker, with its heavy-duty contacts, needs no maintenance.

NEW HOOD HAS 3 BIG ADVANTAGES FOR SUBURBAN LIGHTING

The new Form 107 Hood—for suburban and radial-wave reflectors—permits higher mounting; simplifies wiring; and gives positive maintenance of proper light distribution. Reflectors attach directly to hood. Uses easily wired slip-fitter mounting. (Also available top-tapped to replace Form 45L.) Natural-finish die-cast aluminum.

MERCURY LAMP LIFE NOW RATED 6000 HOURS

Life rating of the 400-watt Types B-H1 and F-H1 mercury lamp, in practical use for 12 years, has recently been increased 20 per cent. Users can now expect a full year and a half of service, on the average, from this lamp (6000 hours with 10 burning hours per start), with no change in rated efficiency throughout life. Price remains the same.

41% MORE ILLUMINATION FROM 15,000 LUMEN LAMPS

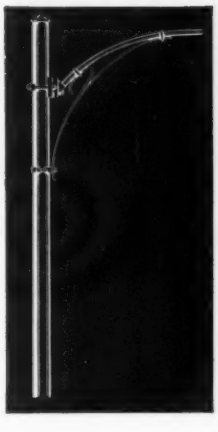
A new luminaire for 15,000 lumen filament or 400-watt mercury lamps, gives the highest utilization efficiency yet achieved for wide streets. By actual test, this luminaire, with its HOLOPHANE refractor, puts 41 per cent more light on the roadway than the widely used deflector type of luminaire.

2 NEW SUBURBAN REFLECTORS FOR INTERSECTIONS

Added to the line of high-efficiency, low-cost equipment for residential street lighting are two new enclosed, spun-sealed optical units. The new Type CR utilizes a HOLOPHANE offset 4-way refractor to distribute light down all four streets permitting mounting on a short bracket. Type CS uses a rippled globe, produces symmetrical light distribution.

A DEMONSTRATION KIT CALLED 30-STREETS-IN-ONE

Here is the equipment that will help you demonstrate and sell better street lighting more economically. With it, 30 different ways of lighting a street can be shown, with foot-candle values ranging from 0.02 to 0.87, with old types of equipment and the latest in open, enclosed, sodium, and mercury luminaires. Cost, installed, runs about $6000.



UPSWEEP BRACKET NOW MADE FOR STEEL POLES

This attractive, new-style G-E upsweep street-lighting bracket permits dual use of steel poles—especially existing tubular trolley poles. It permits high mounting of luminaires, is easy to wire. Available in 4-, 6-, and 8-ft lengths, for poles from three to nine inches in diameter. Takes slip-fitter or top-tapped hoods.

GOOD STREET LIGHTING BUILDS GOOD WILL

These are the latest of many developments which General Electric has pioneered to help you provide better street lighting at lower cost. More are on the way. Watch for the announcements. For full information on any item, call our nearest office or write to Apparatus Dept., General Electric Company, Schenectady 5, N. Y.

GENERAL ELECTRIC

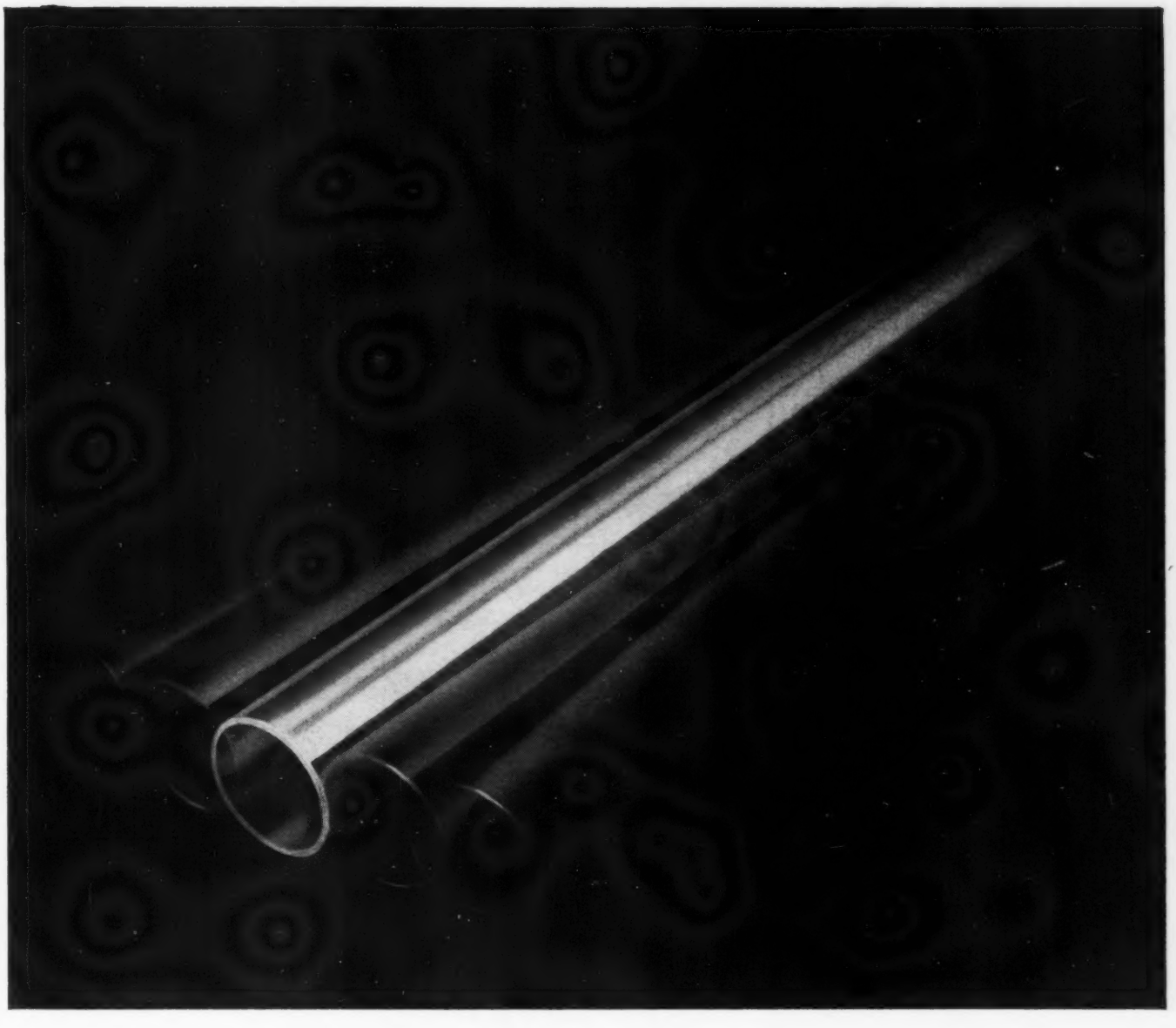
452-64

Coefficients of Utilization For Reflector and Projector Lamps

Adapted from "Application Data for Downlighting Equipment" presented by Lorin C. Brown and Priscilla Presbrey, Westinghouse Electric Corp before the Illuminating Engineering Society at New Orleans, La. Reflection factors for floors are taken as 10 percent.

Lamps 150 w and 300 w	Ceiling	75%			50%			30%	
	Walls	50%	30%	10%	50%	30%	10%	30%	10%
	Room Index	Coefficients of Utilization							
R-40 SPOT Bare	J	.68	.64	.60	.67	.63	.60	.63	.60
	I	.76	.71	.68	.74	.70	.68	.68	.67
	H	.79	.76	.73	.78	.75	.72	.74	.72
	G	.83	.80	.76	.81	.79	.76	.77	.75
	F	.86	.83	.79	.84	.82	.79	.80	.78
	E	.90	.87	.84	.88	.86	.84	.85	.83
	D	.94	.92	.89	.91	.90	.88	.89	.87
	C	.97	.94	.92	.94	.93	.91	.91	.90
	B	.99	.98	.96	.97	.96	.94	.94	.93
	A	1.01	1.00	.98	.99	.98	.96	.96	.95
R-40 SPOT Flush Shielding	J	.68	.64	.60	.67	.63	.60	.63	.60
	I	.74	.71	.68	.73	.70	.68	.68	.67
	H	.78	.75	.72	.76	.74	.71	.73	.71
	G	.81	.78	.75	.79	.77	.74	.76	.73
	F	.83	.80	.78	.81	.79	.77	.78	.76
	E	.86	.84	.82	.84	.82	.81	.81	.80
	D	.90	.88	.86	.87	.86	.84	.85	.83
	C	.92	.90	.88	.89	.88	.87	.87	.86
	B	.94	.93	.91	.92	.91	.90	.90	.89
	A	.96	.94	.93	.93	.92	.91	.91	.90
R-40 SPOT 13° Shielding	J	.65	.61	.58	.64	.60	.58	.60	.58
	I	.69	.66	.64	.68	.65	.64	.64	.63
	H	.72	.69	.67	.71	.69	.67	.68	.66
	G	.74	.72	.69	.73	.71	.69	.70	.68
	F	.76	.74	.72	.74	.73	.71	.72	.70
	E	.78	.77	.75	.77	.76	.75	.75	.74
	D	.80	.79	.78	.79	.78	.77	.77	.76
	C	.82	.81	.80	.80	.79	.78	.78	.77
	B	.84	.83	.82	.82	.82	.81	.81	.80
	A	.86	.85	.84	.83	.83	.82	.82	.81
R-40 SPOT 30° Shielding	J	.55	.52	.50	.55	.52	.50	.52	.50
	I	.59	.57	.55	.58	.56	.55	.55	.54
	H	.61	.59	.57	.60	.59	.57	.58	.56
	G	.63	.61	.59	.61	.60	.59	.59	.58
	F	.64	.63	.61	.63	.62	.60	.61	.60
	E	.66	.65	.64	.65	.64	.63	.63	.62
	D	.68	.67	.66	.67	.66	.65	.65	.64
	C	.69	.68	.67	.68	.67	.66	.66	.65
	B	.71	.70	.69	.70	.69	.68	.68	.67
	A	.72	.71	.70	.71	.69	.68	.68	.67
R-40 SPOT 45° Shielding	J	.47	.45	.43	.47	.44	.43	.44	.43
	I	.50	.48	.47	.49	.47	.47	.46	.46
	H	.52	.50	.49	.51	.49	.49	.49	.48
	G	.53	.52	.50	.52	.51	.50	.50	.49
	F	.54	.53	.52	.53	.52	.51	.52	.51
	E	.56	.55	.53	.55	.54	.53	.53	.52
	D	.57	.57	.56	.56	.56	.55	.55	.54
	C	.58	.58	.57	.57	.57	.56	.56	.55
	B	.59	.59	.58	.58	.58	.57	.57	.56
	A	.60	.60	.59	.59	.59	.58	.58	.57
R-40 FLOOD Bare	J	.59	.53	.49	.58	.52	.48	.52	.48
	I	.68	.63	.59	.67	.62	.58	.61	.58
	H	.72	.67	.64	.71	.67	.64	.67	.63
	G	.77	.72	.69	.75	.71	.68	.70	.67
	F	.80	.76	.72	.78	.74	.71	.73	.71
	E	.85	.81	.78	.83	.80	.77	.79	.76
	D	.90	.87	.83	.87	.85	.83	.85	.82
	C	.93	.90	.87	.90	.88	.86	.87	.84
	B	.97	.94	.92	.94	.92	.90	.91	.88
	A	.99	.96	.94	.96	.94	.92	.93	.90
R-40 FLOOD Flush Shielding	J	.57	.52	.49	.56	.51	.48	.51	.48
	I	.64	.60	.57	.63	.59	.56	.57	.55
	H	.67	.64	.62	.66	.63	.61	.62	.60
	G	.71	.67	.65	.70	.67	.64	.66	.64
	F	.74	.70	.68	.72	.70	.67	.69	.67
	E	.78	.75	.73	.76	.74	.72	.73	.71
	D	.82	.79	.77	.80	.78	.76	.77	.75
	C	.84	.82	.80	.82	.80	.79	.79	.77
	B	.86	.85	.83	.84	.83	.82	.82	.81
	A	.89	.87	.85	.86	.85	.83	.84	.82
R-40 FLOOD 13° Shielding	J	.50	.47	.45	.50	.47	.45	.46	.44
	I	.55	.52	.50	.55	.52	.50	.51	.49
	H	.59	.56	.54	.58	.55	.53	.55	.52
	G	.61	.58	.57	.60	.57	.55	.57	.55
	F	.63	.60	.59	.62	.59	.57	.59	.57
	E	.65	.63	.62	.64	.62	.61	.61	.60
	D	.67	.66	.65	.66	.65	.64	.64	.63
	C	.69	.68	.67	.67	.66	.65	.65	.64
	B	.71	.70	.69	.69	.68	.67	.67	.66
	A	.73	.72	.71	.71	.70	.69	.69	.68

Lamps 150 w	Ceiling	75%			50%			30%	
	Walls	50%	30%	10%	50%	30%	10%	30%	10%
	Room Index	Coefficients of Utilization							
PAR-38 SPOT Bare or Flush Shielding	J	.74	.69	.66	.73	.69	.66	.68	.66
	I	.81	.77	.75	.80	.76	.74	.73	.72
	H	.84	.81	.78	.83	.80	.78	.79	.77
	G	.87	.84	.81	.85	.83	.81	.82	.80
	F	.90	.87	.84	.87	.85	.83	.84	.83
	E	.94	.91	.89	.91	.90	.88	.87	.86
	D	.97	.95	.93	.94	.93	.92	.93	.91
	C	.99	.97	.95	.96	.95	.94	.94	.93
	B	1.02	1.01	.99	.99	.98	.97	.97	.96
	A	1.03	1.02	1.00	1.00	1.00	.99	.98	.97
PAR-38 SPOT 13° Shielding	J	.72	.68	.65	.71	.67	.65	.67	.65
	I	.77	.74	.72	.76	.73	.71	.72	.71
	H	.80	.77	.75	.78	.76	.74	.75	.73
	G	.82	.80	.77	.80	.79	.77	.77	.76
	F	.84	.82	.80	.82	.81	.79	.79	.78
	E	.87	.85	.83	.85	.84	.82	.82	.81
	D	.89	.88	.86	.87	.87	.86	.86	.85
	C	.91	.90	.88	.89	.89	.88	.88	.87
	B	.93	.92	.91	.91	.91	.90	.90	.89
	A	.95	.94	.93	.92	.92	.91	.91	.90
PAR-38 SPOT 30° Shielding	J	.64	.61	.59	.63	.60	.59	.59	.58
	I	.68	.66	.64	.67	.65	.63	.63	.62
	H	.70	.68	.66	.69	.67	.66	.66	.65
	G	.72	.70	.68	.71	.70	.68	.68	.67
	F	.74	.72	.70	.72	.71	.69	.70	.69
	E	.76	.75	.73	.74	.73	.72	.72	.71
	D	.78	.77	.76	.77	.76	.75	.75	.74
	C	.80	.79	.77	.78	.77	.76	.76	.75
	B	.81	.80	.79	.80	.79	.78	.78	.77
	A	.82	.81	.80	.81	.80	.79	.79	.78
PAR-38 SPOT 45° Shielding	J	.55	.53	.50	.55	.52	.50	.51	.50
	I	.58	.57	.55	.58	.56	.55	.54	.53
	H	.60	.59	.57	.60	.58	.57	.57	.56
	G	.62	.61	.59	.61	.60	.59	.59	.58
	F	.64	.63	.61	.62	.62	.60	.60	.59
	E	.66	.65	.64	.64	.64	.62	.62	.61
	D	.68	.67	.66	.66	.66	.65	.64	.63
	C	.69	.68	.67	.67	.67	.66	.66	.65
	B	.70	.69	.69	.69	.68	.68	.67	.67
	A	.71	.70	.70	.70	.69	.69	.68	.68
PAR-38 FLOOD Bare or Flush Shielding	J	.71	.66	.63	.70	.65	.62	.64	.61
	I	.78	.73	.71	.76	.72	.70	.70	.69
	H	.83	.78	.75	.80	.77	.74	.76	.74
	G	.85	.81	.80	.83	.80	.77	.79	.77
	F	.87	.84	.83	.85	.83	.81	.82	.80
	E	.91	.89	.86	.90	.88	.85	.86	.84
	D	.95	.93	.91	.93	.92	.90	.90	.89
	C	.97	.96	.94	.95	.94	.92	.92	.91
	B	1.00	.99	.97	.97	.96	.95	.95	.94
	A	1.02	1.00	.99	1.00	.99	.97	.97	.96
PAR-38 FLOOD 13° Shielding	J	.70	.65	.63	.69	.65	.62	.64	.61
	I	.74	.71	.69	.73	.70	.68	.69	.68
	H	.77	.75	.72	.76	.74	.72	.73	.71
	G	.79	.77	.75	.78	.76	.74	.75	.74
	F	.81	.79	.77	.79	.78	.76	.77	.76
	E	.84	.83	.81	.82	.81	.80	.80	.79
	D	.87	.86	.84	.85	.84	.83	.83	.82
	C	.88	.88	.86	.87	.86	.85	.85	.84
	B	.90	.90	.88	.89	.88	.87	.87	.86
	A	.92	.91	.90	.90	.89	.89	.88	.87
PAR-38 FLOOD 30° Shielding	J	.59	.56	.54	.59	.55	.53	.55	.53
	I	.63	.60	.59	.63	.60	.58	.59	.57
	H	.65	.63	.62	.65	.63	.61	.62	.60
	G	.68	.66	.64	.67	.65	.63	.64	.62
	F	.70	.68	.66	.68	.67	.65	.65	.64
	E	.72	.70	.69	.70	.69	.68	.68	.67
	D	.74	.73	.71	.72	.71	.70	.70	.70
	C	.75	.74	.73	.73	.73	.72	.71	.71
	B	.77	.76	.75	.75	.75	.74	.73	.73
	A	.78	.77	.76	.76	.76	.75	.74	.74
PAR-38 FLOOD 45° Shielding	J	.52	.49	.47	.51	.49	.47	.48	.47
	I	.55	.53	.51	.54	.52	.51	.51	.50
	H	.57	.55	.53	.56	.54	.53	.53	.53
	G	.58	.57	.55	.57	.56	.55	.55	.54
	F	.59	.58	.57	.58	.57	.56	.56	.56
	E	.61	.60	.59	.60	.59	.59	.58	.57
	D	.63	.62	.61	.61	.61	.60	.60	.59
	C	.64	.64	.63	.63	.63	.62	.62	.61
	B	.65	.65	.64	.64	.64	.63	.63	.62
	A	.66	.66	.65	.65	.65	.64	.64	.63



REVERE detects *VIBRATION* at a distance

DO you know that vibration can be present in the tubes of a condenser, though not perceptible in the shell? Putting the palm of your hand on a condenser is not a good test for destructive vibration. The best test is one carried out in the Revere Research Laboratory in Rome, N. Y., which makes a microscopic examination of the metal as a part of its work in determining causes of tube failure. If vibration contributed to short life, this examination will show it. Vibration accelerates corrosion in several ways. The alternating stresses in time produce cracks across the grain of the metal, weakening it and giving corrosive fluids more points to attack. Vibration also breaks or disrupts or disturbs the thin film on the surface of the metal that protects it and helps reduce the rate of corrosive attack. Of course vibration is but one of a number of factors influencing the service life of condenser tubes, and so when tube life is questioned we always suggest that samples from failed tubes be sent to us. We may be able to help you, as we have others, with suggestions that should materially extend the period between re-tubings.

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Founded by Paul Revere in 1801

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Primary and Secondary Dead Ends

An adaptation from urban construction standards of Tennessee Valley Power Distributors Association, Chattanooga, Tenn.

PRIMARY DEAD ENDS

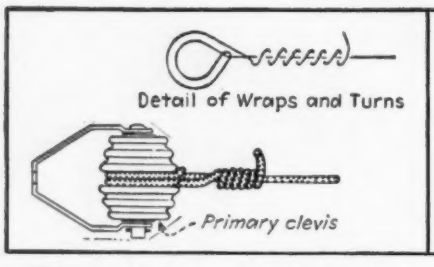


FIG 1— 2.4/4 kv, solid conductors No. 4 and smaller

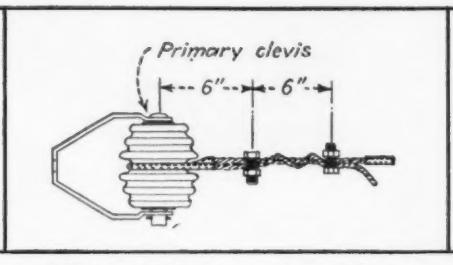


FIG 2— 2.4/4 kv, stranded conductors No. 2/0 and smaller

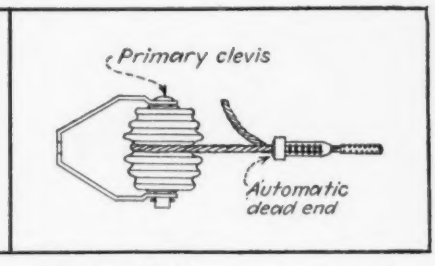


FIG 3— 2.4/4 kv, conductors larger than No. 2/0

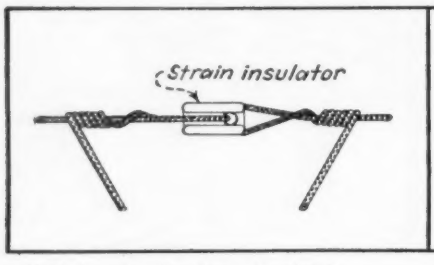


FIG 4— Breaker for series circuit

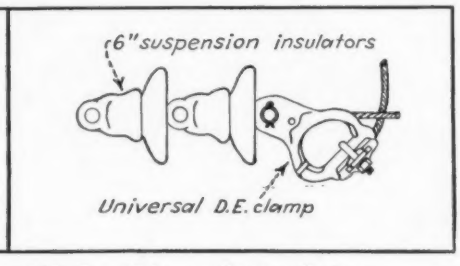


FIG 5— 12 kv, conductors all sizes

NOTES

1. For long span construction (over 200 ft), use Fig 2 for No. 4 conductors.
2. In Fig. 5 use three insulators if attaching to steel.

SECONDARY AND SERVICE TIES AND DEAD ENDS

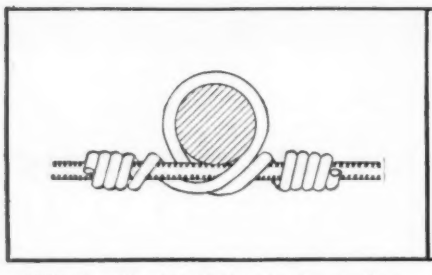


FIG 1— Use No. 8 tie wire for conductors No. 4 or smaller; No. 6 for larger

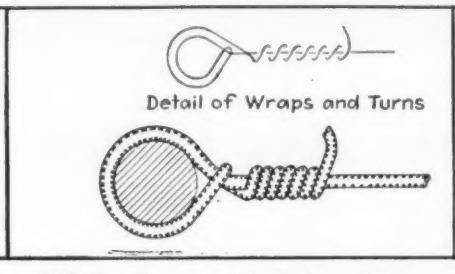


FIG 2— For use with solid conductors No. 4 and smaller

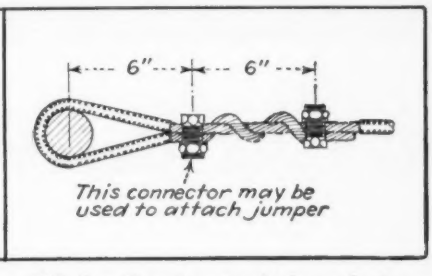


FIG 3— Use for standard conductors No. 2/0 and smaller

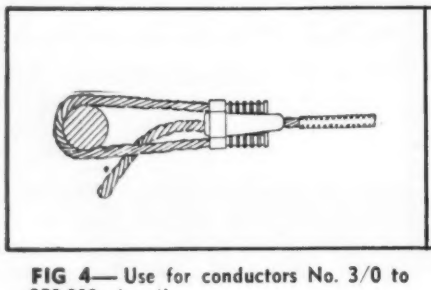


FIG 4— Use for conductors No. 3/0 to 250,000 cir mil

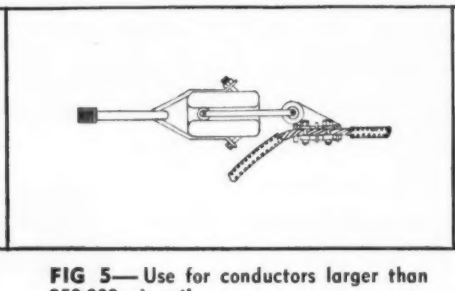


FIG 5— Use for conductors larger than 250,000 cir mil

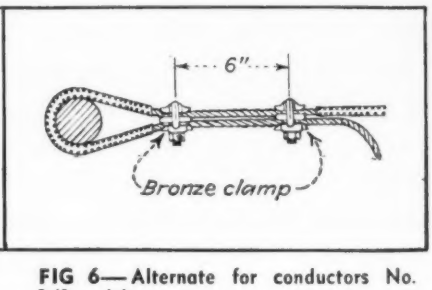


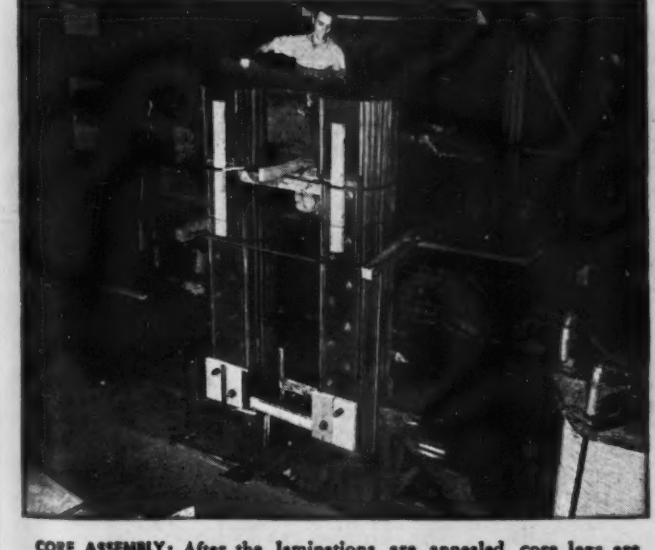
FIG 6— Alternate for conductors No. 3/0 and larger

NOTES: 1. Bare conductors are to be installed in the same manner as for weatherproof.
2. For long span construction (over 200 ft) use Fig. 3 for No. 4 conductors.

ANSFORMERS

CUTTING: Burred edges of laminations, caused by improper cutting, may result in abnormally high core loss through short circuiting when cores are stacked. Through careful cutting with sharp shears this contribution to core loss is materially reduced. Also mechanical stresses, a contributing factor to increased hysteresis losses, are greatly reduced by sharp shearing of the laminations. Core laminations for large transformers are drilled or punched after cutting so that they may be bolted together for greater mechanical strength.

ANNEALING: Stresses resulting from the shearing operation are relieved by annealing. The annealing process also provides an oxide coating which insulates the laminations from each other . . . an important factor in the reduction of eddy current losses. Automatically regulated overhead ovens maintain correct temperatures for annealing . . . thus assuring proper performance of the cores.



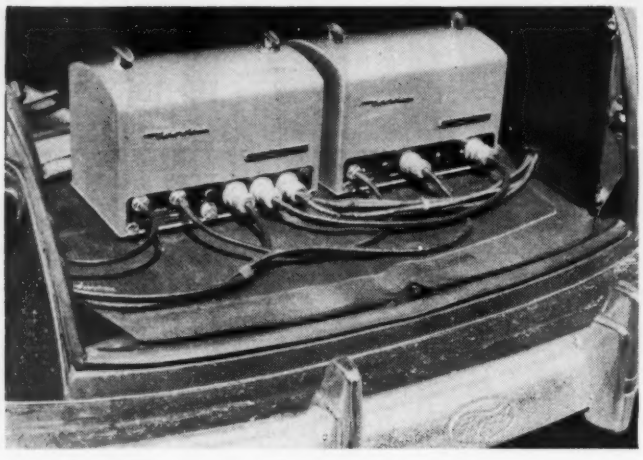
CORE ASSEMBLY: After the laminations are annealed, core legs are stacked and bolted. Extra core lamination insulation and core-cooling oil ducts are added to reduce inter-lamination resistance and eliminate possible hot spot sources. Core bolts are provided with insulating sleeves to prevent short circuiting of the laminations. After stacking, the legs are set upright and the bottom cross laminations are placed into position as shown in photo. Care is exercised to prevent "air-gaps" at the joints between edges of the cross laminations and leg laminations, to keep exciting current at a minimum.

ASSEMBLED CORE: Here we see a core assembled ready for placing windings. The laminations have been properly cut to avoid abnormally high core losses . . . proper annealing has further relieved stresses and oxidized the laminations for insulation and reduction of losses . . . the laminations have been insulated, stacked and provided with core-cooling oil ducts. The core has been carefully assembled to eliminate "air-gaps" at joints and the bottom clamping structure has been installed. The core is now ready to receive the transformer windings.

ONEY ELECTRIC COMPANY

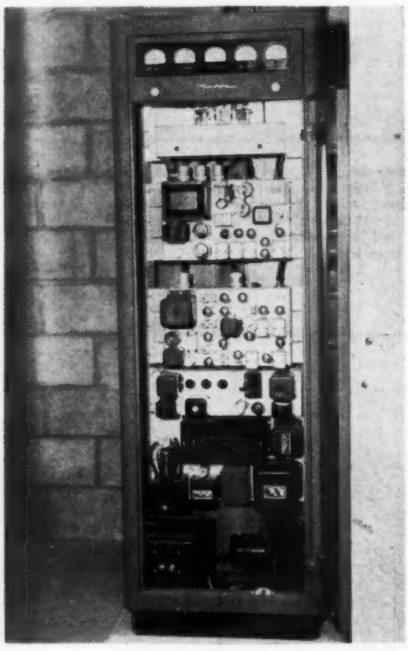
FACTORIES AT SAINT LOUIS, MISSOURI, AND TORONTO, ONTARIO, CANADA

Two-Way FM Radio Speeds Utility Operations



TRANSMITTER and receiver installation located in trunk of car

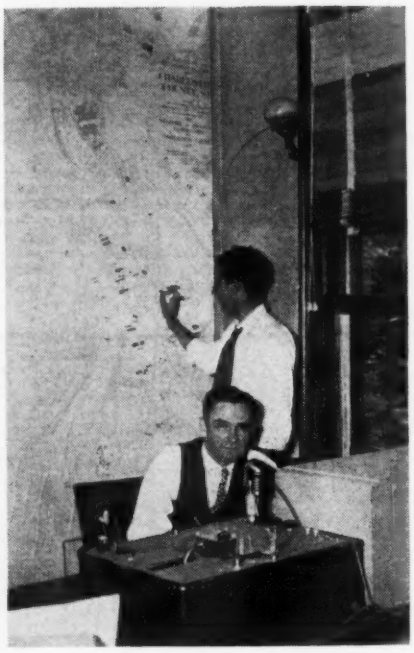
CONTROL HEAD and microphone installed in front compartment



South Carolina Power Company shortens line interruptions from 1 hour to 2 minutes. To accomplish this, crews and needed material are located and dispatched quickly by radio, with a fifty-mile range from car to station and 10 to 15 from car to car.

Complete system comprises one 250-w station with 300-ft antenna tower, two 50-w portable stations with 85-ft poles and 37 mobile units of 50-w capacity. Transmitters and receivers are compactly installed in both cars and dispatching center.

TRANSMITTER AND RECEIVER in unit central station with cabinet door open. Unit is 250-w frequency-modulated type FSTR-250BR (left)



OPERATING CHART for spotting location of radio-equipped cars and trucks. Small magnets are placed on the metal-backed map (right)

• • •

Safeguarding Joints Against Moisture

All cable failures occurring in manholes on an eastern utility are analyzed by a qualified employee. Tests of moisture content made by dipping cable and joint insulation in petrolatum heated to 290 F and by checking insulation condition indicate the type of repair needed. The decision is usually: (1) To replace one cable section; (2) to replace two sections; (3) to remake the joint; (4) to make an extension joint; or, (5) to piece out and make two joints in the manhole. Extension joints have been limited to a length of 40 in. This suffices to make up a joint if the fault is in the wipe.

Varnished cambric tape, 10 mils thick, is made up in small rolls 1 in. and 1.5 in. wide. This is packed in tins and sealed with petrolatum. When preparing these small rolls from larger commercial rolls, the cambric is boiled out in hot petrolatum. This leaves a light film of petrolatum on the cambric.

During the taping of the joint, the splicer occasionally boils out a joint by pouring hot petrolatum over the insulated conductors. Tests show that a 3-lb pull on the varnished cambric tape is most effective.

The number and dimensions of stepping required in making shielded-type joints operating above 15 kv are specified. These are made by tying down the conductor insulation with a dry string and tearing off successive layers of tapes. The use of a knife for this purpose is not allowed. Some splicers use a piece of linen thread with a lead weight at each end. The thread is wrapped around the conductor insulation, the weights holding the thread taut. The solder that

Improved **LIFE-SPAN** *treatment now does the entire pole-preserving job!*

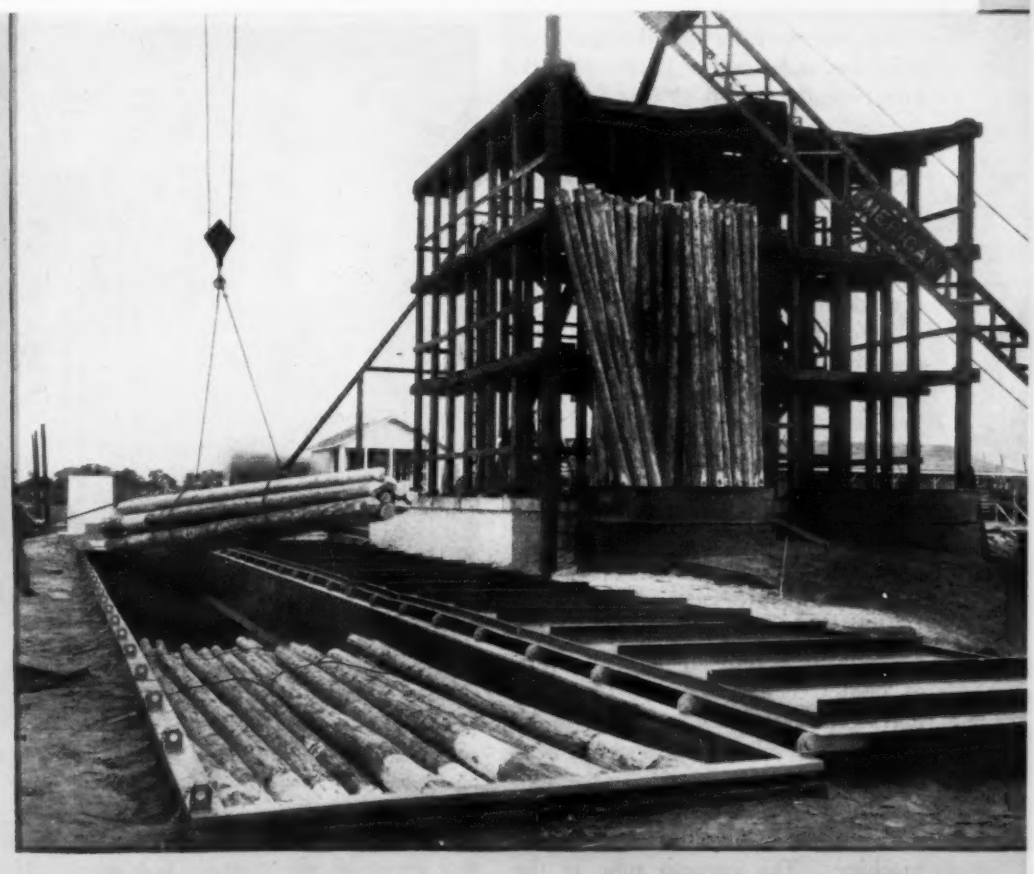
PROVIDES COMPLETE PROTECTION FROM TOP TO BUTT WITH DOUBLE AMOUNT OF PRESERVATIVE AT GROUND LINE

Here is the biggest news for pole users since Life-Span poles were first introduced. It's news of an improved method of treatment—a treatment that gives better and longer lasting results than ever before. Now this improved Pentachlorophenol treatment does the entire pole preserving job. No other ground line protection is needed. Hot and cold treatments from top to butt sterilize the sapwood to its full depth. It gives the pole immunity to decay organisms and wood eating insects that will carry it through to obsolescence. In addition to Western Red Cedar, this improved Life-Span process is now applied to Douglas Fir, Western Larch and Lodgepole Pine. To assure uniform results a proper treating formula is applied to each species treated. In each pole the Pentachlorophenol content is Guaranteed. Exhaustive test plot and field tests for the past ten years have proved the unfailing efficiency of this new over-all treatment.

Life-Span poles are clean, easy to handle, non-irritating, non-conductive. Before new poles are ordered, get full information on the improved full length LIFE-SPAN Pentachlorophenol treatment. Address inquiry to any of the companies listed below.

THE TREATING PROCESS

Improved Life-Span treating process includes two full-length pole immersions, a hot and a cold. Hot high toxic solution sterilizes the sapwood, drives out moisture, expands air in the wood cells. Cold immersion contracts the expanded air in the wood cells and creates a sufficient vacuum to pull the Pentachlorophenol solution deep into the sapwood. Incising the pole at the ground line area results in double concentration of the preservative and double protection in that area.



LIFE-SPAN

Sold only by the following:

SCHAEFER-HITCHCOCK CO.
Sandpoint, Idaho
Suppliers for Joslyn Mfg. & Supply Co.

PAGE & HILL CO.
Minneapolis, Minnesota
50 Church Street, New York, N. Y.

B. J. CARNEY & CO.
Spokane—Minneapolis

NAUGLE POLE & TIE CORP.
Chicago, Illinois

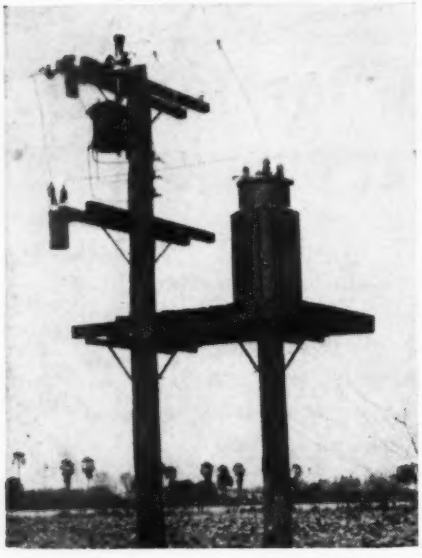
TREATING CO. Minneapolis Minnesota

is used is made up of 38 percent tin and 62 percent lead, based on numerous tests of joint wipes. It is also supplied in bars of 50-50 mixture for soldering iron use. Tightness of wipe and ease of manipulation were the important points. Solder deficient in tin is likely to be porous. It may occur in use and be corrected by adding bar solder. Solder deficient in lead is corrected by the addition of lead from sleeves. Cable sheath is not allowed for such use because of possible impurities present.

All high-tension joints are filled with a semi-viscous compound heated to 290 F before pouring. After being filled, the joint is allowed to settle for 1 hr. This permits trapped air to escape and the compound to contract. The joint is then refilled and sealed.

• • •

Rural Step-Up Station Mounted on Platform



PLATFORM MOUNTS step-up transformer serving rural line

To SERVE approximately 25 miles of 7,620-v rural line, including two towns, the Florida Power and Light Co developed a platform type step-up station. The installation illustrated was made on the company's line near Sanford, Fla.

The large transformer, 100 kva, 2.4/8-kv, was mounted on a platform because of its weight and the fact that no hangers were furnished. Attached to the line pole, the platform was constructed of four 9-ft highline crossarms, four 6-ft angle irons with Joslyn braces, regular platform planks, and a stub pole salvaged from a solid piece of abandoned transmission pole from another location on the company's system.

A 50-amp Kyle breaker was mounted on a set of 6-pin double-arms. It was connected on the 2.4 kv side of the transformer as protection against losing the line due to lightning or temporary faults. A 3-kva transformer mounted on the top crossarm serves a nearby residence.

• • •

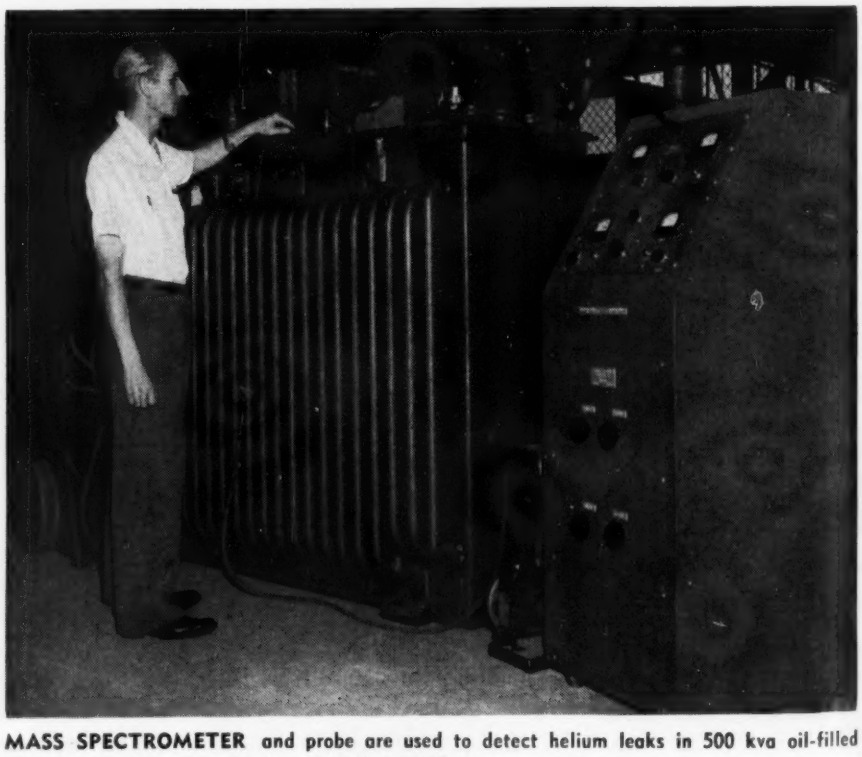
Spectrometer Detects Transformer Leaks

Engineers of the Test Bureau, Consolidated Edison Co of New York, Inc, recently employed a new method for testing oil-filled transformers for leaks, using the mass spectrometer. The mass spectrometer is a compact, portable machine 5-ft high. It instantly detects presence of helium—being capable of noting one part of the gas in 200,000 parts of air. Air is picked up by a probe which consists of a minute orifice in a flat copper lip attached to a long and flexible rubber tube.

Probes for helium leaks

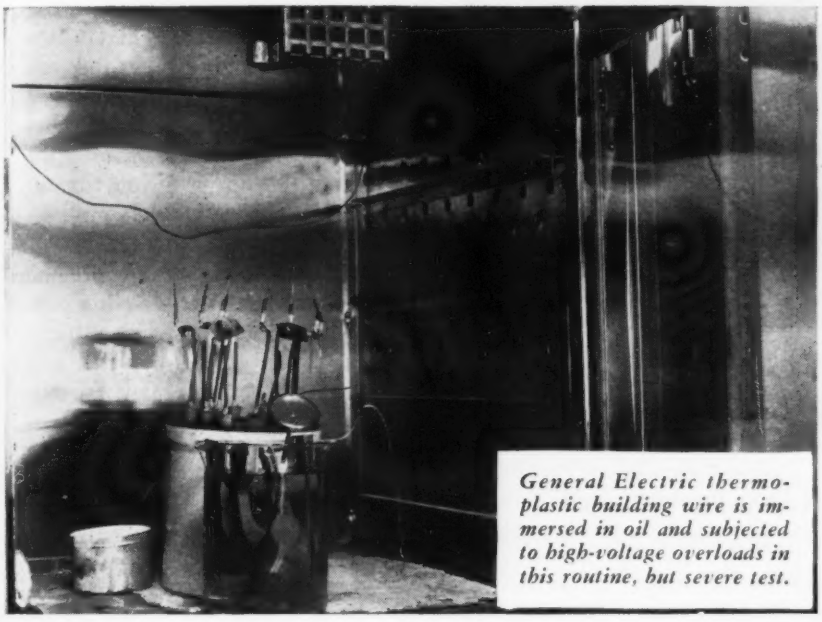
In this method, the hermetically sealed transformers being tested are filled with helium under 7-lb pressure. Then an operator, furnished with a probe, goes over the outside of the equipment to pick up any quanities of helium being liberated from the hermetically-sealed case.

If there is a leak, the escaping helium is picked up by the probe and passes through the spectrometer's vacuum tube—literally the heart of the machine. The vacuum tube in the spectrometer is in the shape of a rough V. At one end is a filament that gives off electrons. These electrons bombard the molecules of any gas entering the tube to form ions. If helium enters, helium ions are formed; any other gas will form its



MASS SPECTROMETER and probe are used to detect helium leaks in 500 kva oil-filled transformer cases that are hermetically sealed

STANDS UP TO OIL *unnaturally*



General Electric thermoplastic building wire is immersed in oil and subjected to high-voltage overloads in this routine, but severe test.

Sooner or later, oil penetrates and softens most insulations of natural organic origin. But General Electric's thermoplastic building wire has the *un*natural ability to resist oil year after year with no weakening in its outer line of defense. Chemically, it simply *ignores* the oil, even when coated with it, or submerged in it.

Users of General Electric Types T and TW no longer fear the conditions that may subject building wire to oil in installation or service . . . greasy hands, leaking pipes, running wires to process equipment. And they're equally unconcerned about moisture and most chemical fumes or vapors.

What's more, this *un*naturally long-lived insulation saves time for the installer, too. It pulls easily, strips cleanly, and is highly abrasion-resistant. No wonder it has been accepted so rapidly as a permanent advance!

Thermoplastic
First . . . and foremost
Type T Building Wire

Because General Electric pioneered thermoplastic, you get the benefit of extra years of improvement when you add "G.E." to your specifications for Types T and TW building wires. To learn about their long-term savings, write to Section W55-127, Appliance and Merchandise Department, General Electric Company, Bridgeport 2, Conn.

*Trade-Mark Reg. U. S. Pat. Off.

GENERAL ELECTRIC

AROUND THE CIRCUIT with your Merchandise Distributor

ANOTHER THERMOPLASTIC-INSULATED WIRE that has excellent electrical and

physical characteristics is General Electric *fixture wire,* Types TF & TFF. Use them in wiring lighting fixtures when you want small diameter, single-conductor wires that are easy to handle in every way. They can be identified easily by the bright, permanent color coding.

NOT ONE — BUT THREE TYPES of Flamenol* portable cords are made by General Electric for use on portable tools and appliances, ranging from electric fans to powerful grinding machines. Select heavy-duty, medium-duty, or rip-cord to fit your needs. All are available in a variety of sizes and strandings.

THIS OLD MAN IS SPRYER THAN EVER after fifty years of useful service. We're talking about good old BX* armored cable, which is fifty years old this year. A product has to be good to stick that long — one of the reasons that so many General Electric products today are still being sold after many years on the market.

YOU'VE GOT TO PUT POWER IN TO GET POWER OUT — so don't forget General Electric's service entrance and service drop cables and fittings in planning industrial or residential wiring. They are backed by the electrical and

manufacturing experience of the leading name in wires and cables.

A chain is only as strong as its weakest link. Prevent weak links in your product by using ILLINOIS bushings produced to meet your engineers' most exacting specifications.

ILLINOIS' thorough control of production methods results in the manufacture of porcelain bushings of high dielectric and great mechanical strength, with the utmost in dimensional accuracy. Careful kiln drying and firing, at constant temperatures, prevent internal stress.

These bushings can be standard glaze or radio interference-proof glaze. Dry type bushings are produced for all voltages up to 34.5 kv. Gasket seats are smooth and ground when required.

★

Complete Uniformity
Exact Dimensions
High Dielectric Strength
High Mechanical Strength

★

Specify Illinois Porcelain
for Dependability and Economy

ILLINOIS
ELECTRIC PORCELAIN CO.
MACOMB • ILLINOIS

with ions within the vacuum tube.

Two plates near the filament receive, respectively, a positive and negative charge and this combined repulsion and attraction serves to speed the ions down the vacuum tube to the apex of the V where a magnetic field is located. This field bends the gas ions in their flight, the amount of bending being a function of the molecular weight of the gas. A slotted baffle is built into the tube beyond the bend. At this point only those gas particles having the desired molecular weight (in this instance that of helium) get through due to having only that required exact degree of bending. Beyond the slot the ions are caught by a collector plate where the resulting ion current passes on to an electronic amplifier and registers on a milliammeter.

Helium gas is introduced into the transformer through an existing connection known as a Waterbury fitting. After the test a valve is opened and the helium allowed to escape. Some of the gas remains but it is harmless.

The test engineers believe that their mass spectrometer, made by the Vacuum Electronic Engineering Co, New York City, will have many other uses in the Consolidated Edison system, such as detecting leaks on a length of pipe or a welded joint.

•

Reuniting Mercury in Test Thermometers

MERCURY SEPARATION in test thermometers, caused by jarring in transit, cannot be entirely prevented. However, the following method will generally correct this trouble. If the range of the thermometer is such that the mercury will contract into the bulb at zero F, these steps apply: (1) Place the thermometer bulb in a saturated mixture of salt and finely cracked ice. (2) With lower range thermometers, place the bulb in a bath of dry ice and alcohol. This draws the mercury into the bulb. (3) Hold the thermometer vertically and jar slightly against the palm of the hand or a soft pad. This disperses any bubbles in the mercury. (4) Allow the thermometer to warm up gradually. This expands the mercury into the capillary free of sepa-

Flat Bars

for SIMPLICITY, ECONOMY and INEXPENSIVE TAP-OFFS

BARS require minimum space, may be bent or twisted, connected to apparatus without special joint preparation and in laminated construction have unlimited d.c. capacity.

TUBES provide the highest bus conductor efficiency at a.c. frequencies, have greater rigidity, and may be oil or water cooled.

CHANNELS have large surface area, reduce temperature rise, provide greater rigidity than tubes for long runs and have flat surfaces for tap-off.

ANGLES for ventilated hollow busses have highest rate of heat dissipation, handle greater current density, but require more space for installation.

CABLES solve many problems in conducting extremely heavy currents in confined space or in connecting moving apparatus such as furnaces of the arc or resistance types.

FLAT BARS require minimum space for making connections to apparatus without the necessity of special joint preparation. The low resistance of the copper and its high thermal conductivity result in low losses and provide an outlet for conducted heat from the apparatus. The bars may easily be bent flatwise or edgewise, or twisted for making the connections.

For heavy currents, due to the large surface area of the laminations, generated heat is readily dissipated. Direct current multi-bar busses have unlimited capacities with adequate copper section and ventilation.

Alternating current busses of flat bars are *limited* in capacity due to unevenness of current distribution in the laminations. 3000 amperes may be considered as the limit of a laminated bus construction for 60 cycles frequency without intricate physical locations of the bars, and without transpositions of the bars.

Anaconda Bus Conductors are available also in four other shapes. Each offers advantages of its own. In addition, because of its high electrical and thermal conductivity, strength, toughness and corrosion resistance, *copper* is recognized as the most satisfactory bus material. Anaconda Publication C-25 contains further information.

47102

ANACONDA
from mine to consumer

Anaconda

BUS CONDUCTORS

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut

Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD.
New Toronto, Ont.

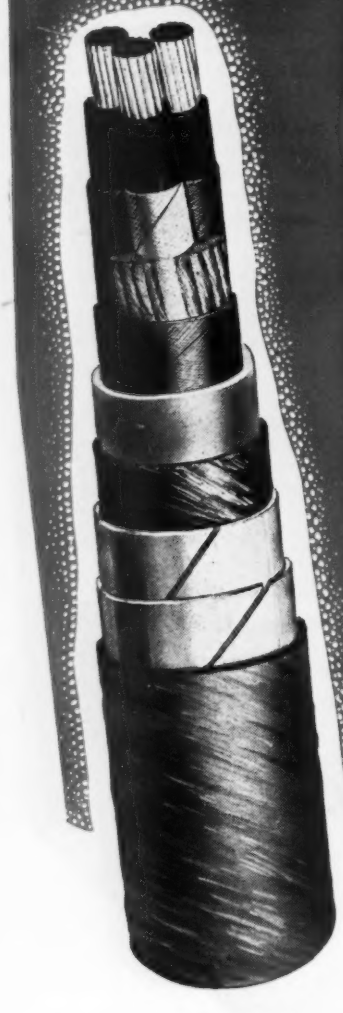
• MAXIMUM PROTECTION AND LONG LIFE •

CRESCENT

Steel Taped

PARKWAY CABLE

Insulated with
CRESCENT ENDURITE
Heat-Resistant
rubber insulation (75°C)
in 600 to 5000 volt range.
Or with
Varnished Cambric for maximum current carrying capacity
or higher voltages.



TYPE RLJFJ
THREE CONDUCTOR

•

Also all standard types of metallic Parkway cables, to I. P. C. E. A. specs. Special cables to customer's specifications.

No other protection required except at points of extreme mechanical hazard. Being well protected from ordinary mechanical injury and easy to install, they provide an economical, permanent underground system.

These cables are widely used for street lighting circuits, railroad yard lighting and signal systems, airport power and lighting circuits and in industrial plants and mines.

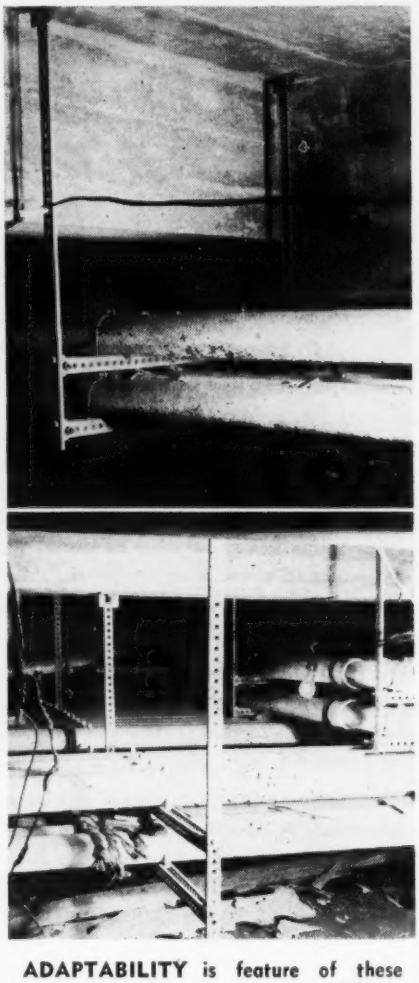
CRESCENT INSULATED WIRE & CABLE CO.
TRENTON, N. J.

CRESCENT
WIRE & CABLE

ration. Caution: When using dry ice, immerse only the bulb. Keep capillary from contact with dry ice.

•

Kindorff Hanger Features Adaptability



ADAPTABILITY is feature of these pipe hangers. In substation work, Pacific Gas and Electric Co is using a conduit support known as a Kindorff hanger. These consist of channel iron with equally spaced holes and four fittings. The channels come in standard lengths and widths for cutting on the job and are designed to meet all field conditions.

•

Antimony Discharges Batteries

A LEAD-ACID storage battery to be "really free from self-discharge" should have grids composed of pure lead. Antimony content, even as little as half a percent, tends to cause self-discharge. This was reported by A. C. Zachlin of Willard Storage Battery Co in a recent paper before The Electrochemical Society. Other conclusions were that the rate of self-

Brand NEW for '48

FORD Bonus* Built TRUCKS

BUILT STRONGER TO LAST LONGER

New all through!

NEW ENGINES! Brand new Six, two new V-8's... up to 145 h.p.

NEW CABS! Million Dollar Cab with living room comfort!

NEW FRAMES! Tougher, more rugged than ever!

NEW BIG JOBS! Biggest Ford Trucks ever... up to 21,500 lbs. G.V.W.

NEW MODELS! Five new series, more than 115 Ford models!

Listen to the Ford Theater over NBC stations Sunday afternoons 5:00 to 6:00 p.m., E.S.T.

Bonus* Built —THE AMAZING RESULT OF AN ENGINEERING PRINCIPLE THAT ASSURES LONGER TRUCK LIFE... and ONLY Ford Trucks Have It!

The great new Ford Trucks for '48 are revolutionary not only because they are *new all through* but because they are the amazing result of a time-proved truck engineering principle. This principle is Ford Bonus Built construction.

Bonus Built=Extra Strength! Every single one of the great new Ford Trucks for '48 is Bonus Built . . . designed and built with a margin of *extra strength* in every vital part. But that is only *part* of this vital truck building principle...

Bonus Built=Work Reserves! This *extra strength* provides WORK RESERVES that pay off for truck operators in two important, money-saving ways . . .

Bonus Built=Greater Range of Use! These Bonus Built WORK RESERVES give Ford Trucks a *greater range of use* by permitting them to handle loads beyond the normal call of duty! That means that Ford Trucks are *not* limited to doing only one single, one specific job!

Bonus Built=Longer Life! What's more, these same WORK RESERVES allow Ford Trucks to relax on the job . . . to do their jobs easier, with less strain and less wear. Thus, Ford Bonus Built Trucks last *longer* because they are built to work *easier!*

See the great new line of Ford Bonus Built Trucks for '48 now!

***BONUS:** "Something given in addition to what is usual or strictly due."— Webster's Dictionary*

LIFE INSURANCE EXPERTS PROVE . . . FORD TRUCKS LAST UP TO 19.6% LONGER!

Perhaps Your reputation hangs by a cord

The finest appliance ever made is helpless if a weak-kneed cord and plug fail to stand up under aging and hard usage. The fact that PWC cord sets won't let a good product down explains why you'll find PWC on the plugs of so many of America's best and most famous makes of radios and electrical appliances.

PWC cords retain their handsome colors, high gloss, and flexibility. They resist grease, chemicals, and age which cause so many cords to fray, rot and crack. That's because they are not only plastic insulated, but developed and made by the men who know plastic best — the world's largest exclusive maker of plastic insulated wire and cable.

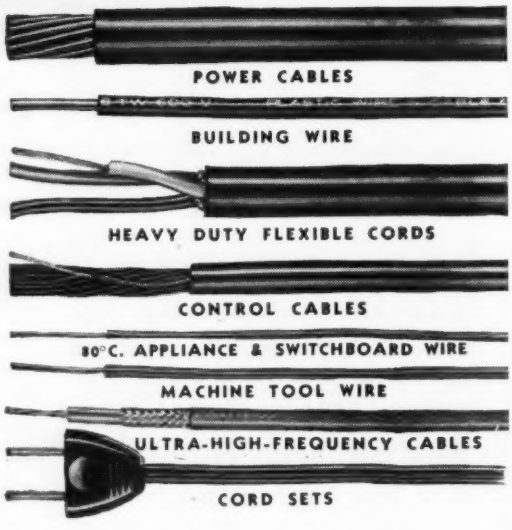
PWC MEANS 10 WAYS BETTER

1. Superior dielectric strength.
2. Can't fray, crack or rot.
3. Low moisture absorption.
4. Greater mechanical strength.
5. Higher abrasion resistance.
6. Flexible over wide temperature range.
7. High chemical resistance.
8. Wide range of permanent, gem-like colors.
9. Non-combustible.
10. Lasting appearance.

Take a tip from a PWC Cord Set . . .

Tailor-made, for every application, special electrical, chemical and physical characteristics are engineered into all PWC products . . . flexible cords, multiple conductors, telephone wires, radio wires, power cable, building wire, apparatus and machine tool wire, coaxial cable, shielded cables, special purpose wire and cable.

Send us your requirements and let us show you the gains from using PWC-engineered products. Our production facilities are geared to meet your needs.



PWC PLASTIC WIRE & CABLE CORP.
407 East Main Street
Jewett City, Connecticut

discharge varies according to the proportion of antimony in the plates; that commercial low-discharge cells lose capacity at or less than 15 percent per year of shelf life; and that there is no appreciable difference in self-discharge of cells with pure lead grids, whether assembled with rubber or wood separators.

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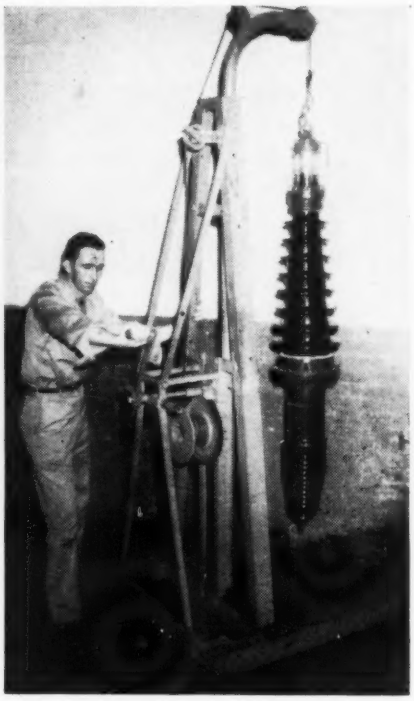
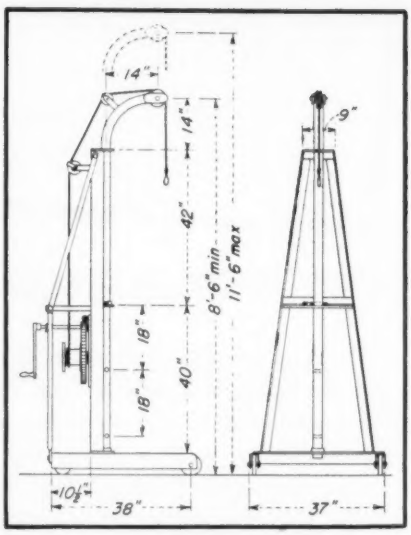
Portable Crane Aids Bushing Repair





ESPECIALLY DESIGNED for lifting and holding large transformer and switch bushings, the portable crane illustrated was built in the substation repair shop of Gulf States Utilities Co, Beaumont, Texas. The low carriage and adjustable lift head have made this design adaptable to all of the equipment sizes in the shop that require lifting.

SCORES

in hockey aren't made with baseball bats!

The business of making "home-runs" calls for much different equipment than that with which "goals" are scored.

Even though baseball bats and hockey sticks are both made of wood, they are "engineered" for different objectives. The various physical and chemical characteristics that make MOSINEE papers win in a wide range of highly specialized industrial uses, are also definitely engineered into these essential papers. MOSINEE paper technicians are equipped with scientific laboratory and production controls, plus practical "know how" based on broad experience in creating papers of many characteristics, such as extreme stretch without loss of tensile strength, high absorbency, moisture repellency, controlled pH for desired alkalinity, acidity, or neutral reaction, etc.

* * *

In many industries MOSINEE paper technicians are helping manufacturers and converters to improve products and production. Call MOSINEE.

MOSINEE PAPER MILLS COMPANY

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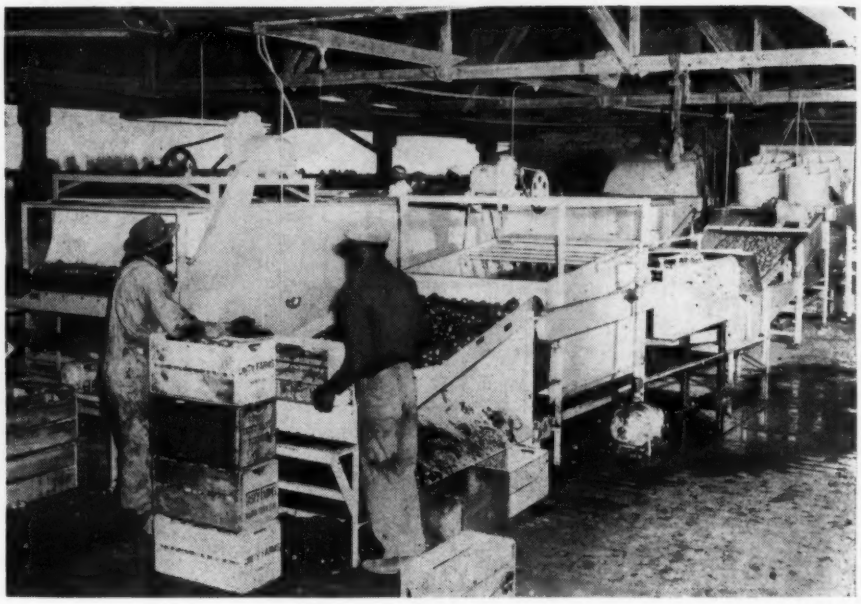
Essential Paper Makers

Please address your letter "Attention Dept. B"

LOAD BUILDING

Electricity Aids Processing of Potatoes

P. PAUL DE MOYA
Manager, Glades District
Florida Power & Light Co
Pahokee, Florida



POTATOES are processed for market. Operation sequence: screening, washing, fungicide treatment, draining, preliminary drying under four fans, carried on cross conveyor (at far end) to entrance of adjacent enclosed section, dried by infrared heat in enclosure, passed under germicidal lamp rays, and conveyed to grading and sizing machine.

IN THE PREPARATION of potatoes for the market, electric power is affording deluxe treatment for the once lowly spud, some of which have become aristocrats such as the federally-inspected potatoes known to the trade as "No. 1 Red Bliss". The processing includes the use of infrared heat, germicidal lamps, and several motors. All the sequential steps are provided in one machine with a total connected load of 85 kw. Installations have been made in packing plants in the Everglades and for them power is supplied by Florida Power & Light Co. The machines are a product of American Machine Corp, Orlando. Operations are outlined from an installation at the State Farmers Market, Pahokee, Florida.

Potatoes brought from the field are put on a conveyor and screened for size. The potatoes larger than 1-in. diam are conveyed to succeeding units, washed and brushed to remove field dirt, treated by immersion in a germicidal solution, passed under four fans where hot air blast removes excess water, and then carried by a short cross-conveyor to the drier.

At the entrance to the drier, moist air from within is exhausted by two fans. In the drier, the potatoes travel a total of 80 ft. On the top 40-ft conveyor they are subjected to a temperature of 165 F provided by a bank of 288 infrared 250-w 115-v lamps, mounted on 7-in. centers and 6-in. above the belt. Midway on the return trip on the lower conveyor the potatoes pass through the rays of four 30-w germicidal lamps. Purpose of the latter lamps is to destroy any bacteria that might later effect the carrying qualities of the potatoes. From the drier, the potatoes are conveyed to a grading table.

The complete machine if placed in a straight line would be 160 ft long. Its capacity is 30,000 lb of potatoes per hour. On the basis of 600 50-lb bags comprising a railroad carload, the machine could handle 24 cars of potatoes in a 24-hr period.

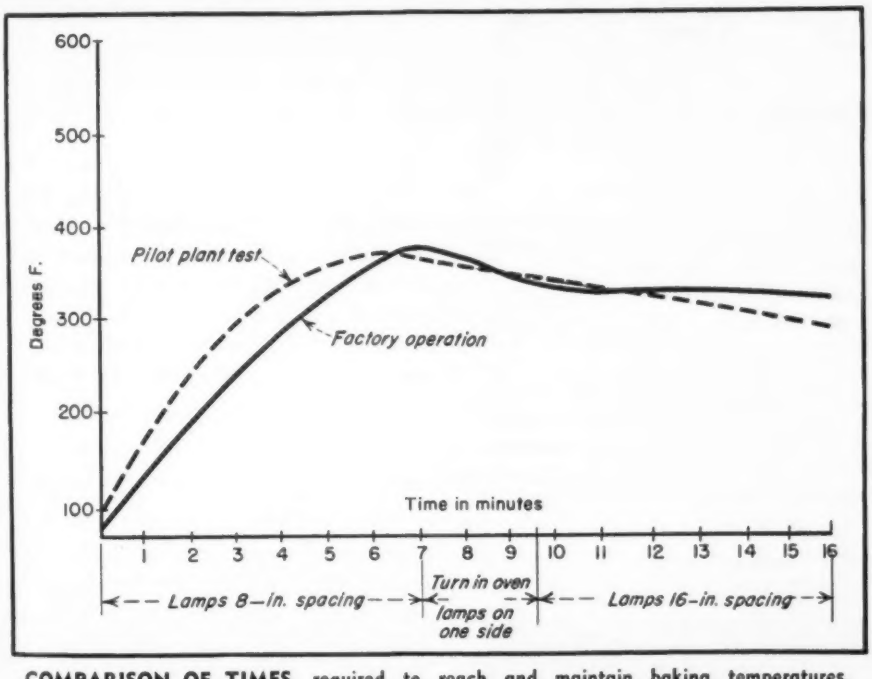
• • •

Infrared Oven Unit Triples Production

INFRARED HEATING solved a production bottleneck at Yale & Towne Mfg Co's Stamford, Conn., plant without interruption of operations. It was necessary to speed up the enameling of locks and builders' hardware to meet post-war demand. An overhead oven and contributory conveyor system was designed by Gifford-Wood Co, Hudson, N. Y., and installed while the older eight gas and oil-fired ovens kept at work. The C. M. Hall Co, Detroit, Mich., furnished the heating units and cooperated in the job. The tunnel is 80 ft long and is served by a conveyor 480 ft in length. This carries the work from the spray booths and dipping tanks on the floor up into the baking tunnel, cools it near the roof and delivers it at the floor level, where it is unloaded from the long conveyor.

There are 576, R-40, 250-w inclosed lamps with inside reflectors in the tunnel. The first leg is for high heating, the 384 lamps being spaced 8 in. apart. The second leg has 16-in. spacing and 192 lamps for maintaining heat. Thirteen sections of lamps are provided, with BullDog control switches to meet varying production requirements. A 2-hp induction motor powers the conveyor through a

OVERHEAD TUNNEL with 144 kw in heating lamps frees valuable factory space. Variable speed drive provides flexibility in handling diversified products



COMPARISON OF TIMES required to reach and maintain baking temperatures. Lamps are spaced 8 in. apart in initial section of oven; on one side at the end; and 16 in. apart for the remainder of the run inside the tunnel

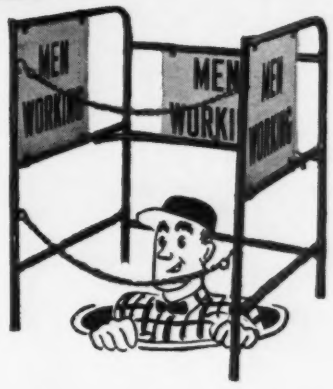
Reeves drive. The conveyor has a speed range of between 3 and 9 fpm. If necessary a smaller motor would suffice. Heat locks are provided at both ends of the tunnel to retard convection losses. Heat is also recirculated within the tunnel to prevent stratification. Lamps can be replaced from outside since a catwalk is provided for maintenance. The conveyor will handle trays of dipping racks.

The time required from placing the

CABLE INSTALLATION CREWS PREFER COPE EQUIPMENT

STRONG COMPACT ATTRACTIVE **WARNING EQUIPMENT**

AVAILABLE IMMEDIATELY



SAFETY GUARD RAIL

Entirely constructed of steel pipe welded for extra strength. The wing bow brace, a "Cope" exclusive, locks the frame in the open position and permits the use of chains on the open side instead of the usual arm hook arrangement. The chains may also be used for locking the folded guard rail to standing equipment or poles while not in use. Warning signs or advertising messages may be attached as illustrated.

Quotations on this or your own design on request.

SAFETY WARNING SIGNS

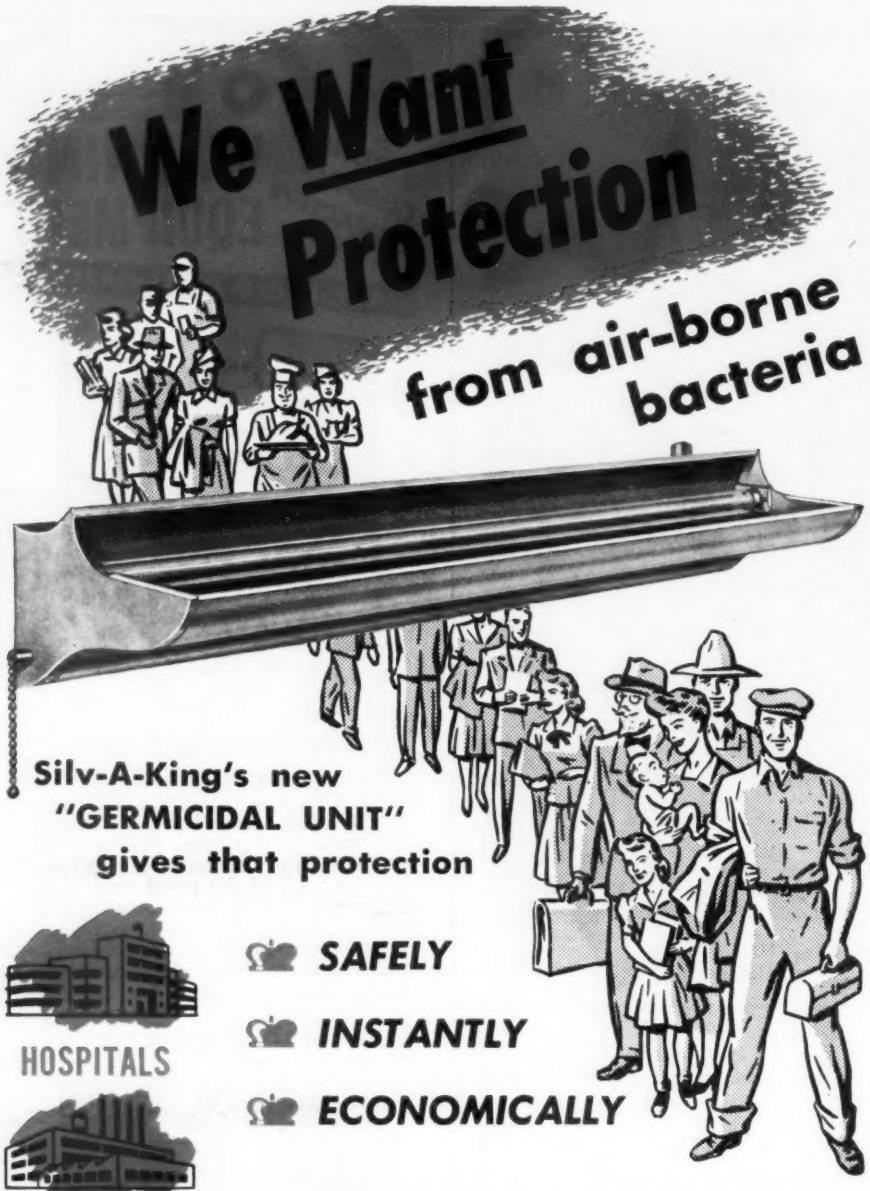
"Cope" Warning Signs are extremely rugged with welded steel frame and steel panel. The legs lock in position and fold as compactly as a card table, requiring a minimum of space. When placed squarely in position they will not blow over or collapse.

The sign illustrated stands 30" high and 18¾" wide with an 18" square panel painted with 5" letters. Quotations on this or specially painted panels on request.

Write for complete catalog and prices.

T. J. Cope INC.
711 S. 50th Street,
Philadelphia 39, Pa.

TOOLS AND EQUIPMENT FOR THE INSTALLATION AND MAINTENANCE OF CABLE FOR OVER FIFTY YEARS



Over 1500 hospitals in the U. S. alone have *proved* that the use of Germicidal Radiation effectively reduces respiratory infection. In homes, schools, nurseries, factories, laboratories, offices — wherever there is need for protection against air-borne bacteria — germicidal radiation is a powerful factor for preserving good health.

Designed to keep pace with giant strides made in the science of air disinfection, this new Silva-A-King Germicidal unit gives positive protection against direct radiation while maintaining maximum concentration of germ-killing energy. Easy to install and completely adaptable to any room with regular electrical outlets.

Free Literature on request. Write Dept. G-48 for Germicidal Bulletin.

BRIGHT LIGHT REFLECTOR CO.
INCORPORATED
Subsidiary of BRIDGEPORT PRESSED STEEL CORPORATION
FAIRFIELD & STATE, BRIDGEPORT 5, CONN.
SALES OFFICES:
Atlanta, Ga. · Baltimore, Md. · Boston, Mass. · Chicago, Ill. · Cincinnati, Ohio · Cleveland, Ohio · Dallas, Texas · Denver, Colorado · Detroit, Mich. · Indianapolis, Ind. · Kansas City, Mo. · Los Angeles, Cal. · Minneapolis, Minn. · New York, N. Y. · Philadelphia, Pa. · Pittsburgh, Pa. · Portland, Ore. · San Francisco, Cal. · St. Louis, Mo.
SILV-A-KING LIGHTING EQUIPMENT

product on the conveyor to shipment is now approximately 1 hr. Formerly 3 to 4 hr were needed. This is quite a contrast from the 24-hr baking time consumed in the 1902 operations of the plant, when burning cordwood. Hard coal cut this to 8 hr and gasoline to 3.3 hr. City gas reduced it to 2 hr, and a combination of fuel oil and gas to 1.5 hr. Today electric heating has brought the oven time down to 16 to 18 min.

•

Aloha to the Brides

"ALOHA and best wishes" is expressed in a practical way for the brides of Honolulu and other towns on the island of Oahu. Each new bride receives an invitation to visit the home service department of The Hawaiian Electric Company, Ltd.

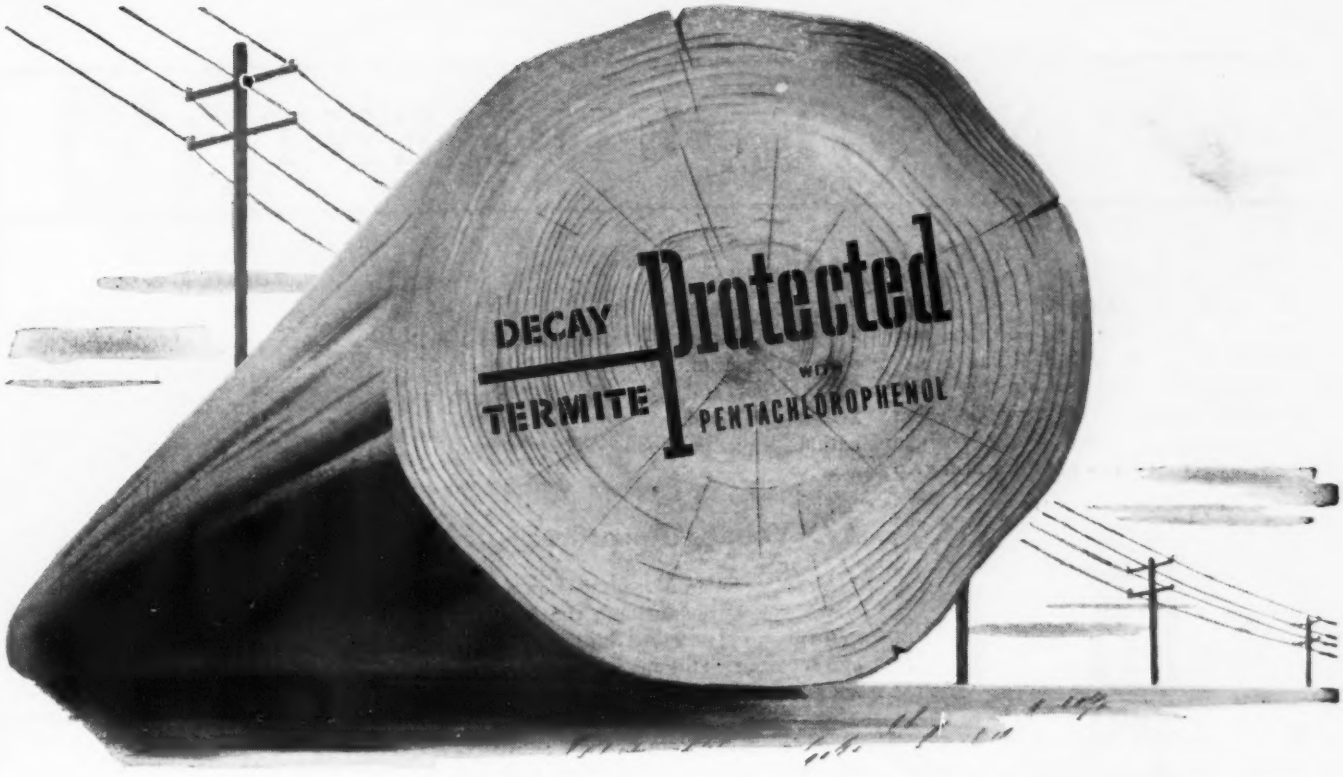
Upon her presentation of a coupon clipped from her invitation she is presented with a "Brides' Recipe Box" which contains a set of forty-five tested basic recipes. The box is custom made and accommodates the recipe cards which are presented at the monthly cooking classes presented in the department. The bride is given a schedule of these classes and is urged to attend in order to collect recipes and obtain cooking instructions.

In addition each lady is presented with a Reddy Kilowatt apron, hot dish holders, a "Basic Seven" kitchen chart, which has been adapted to local foods, and a collection of commercial literature selected to arouse an interest in home building, adequate wiring and an all-electric kitchen.

Promotional Hook

The coupons which the brides present furnish a record of the names, addresses and telephone numbers. These coupons are then turned over to the appliance sales department where they serve as excellent prospects for future sales.

The names of the brides are taken from the vital statistics column of the paper each day. Since the beginning of the project in January, 1947, Miss Erma Meeks, Director of the home service department, reports that over three hundred brides have visited the department to claim their wedding gifts.



You know what you're getting with PENTAchlorophenol!

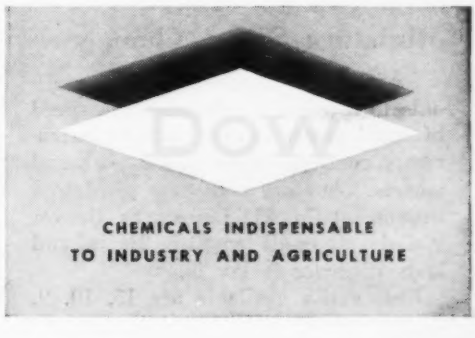
Dependability of protection is one of the important reasons for the big switch to Pentachlorophenol for pole treatment—over and above the proved effectiveness of Pentachlorophenol in preventing decay and termite attacks. With Pentachlorophenol you know what you're getting. It's the same today, yesterday, tomorrow . . . a scientific wood treatment that offers measured toxicity to minimize waste and guesswork.

Pentachlorophenol is applied at low concentrations in petroleum oils by established pressure and nonpressure treating methods. It is available in quantity. Make sure today that your suppliers of treated poles—and lumber—know you want to take advantage of this *modern* wood treatment.

3 more big chlorophenol Advantages

1. You get full strength preservative—measured dependable preservative action.
2. You can duplicate service records. Treating solution is scientifically controlled.
3. You get a *clean* treatment—nonbleeding, nonsticky, poles are easy to handle and work on.

THE DOW CHEMICAL COMPANY
MIDLAND, MICHIGAN



NEW EQUIPMENT

AN ALUMINUM fiber-jawed adjustable insulator fork is a new hot-line tool manufactured by A. B. Chance Co, Centralia, Mo. The tool attaches to an insulated universal pole which when turned opens or closes the jaws. The fiber jaws are said to permit a firm grip

on the insulator without damaging the porcelain or the cement seal at the junction of the porcelain and malleable cap.

The fork can be used to control 8-in. and 10-in. dead-end insulators while making insulator changes on energized lines. It is reported that it can also be used to raise most pin type insulators weighing up to 15 lb. A wing nut and groove arrangement on the aluminum alloy casting allows the jaws to be set at 0, 30 and 60 deg to the spline screw so that pin type insulators can be placed in position on a crossarm.

•

Miniature Speed Changers

SMALL SPEED CHANGERS are now available to increase or decrease the speed of small power devices such as instruments, controls, experimental work and models. They are a product of Metron Instrument Co, 432 Lincoln St, Denver 9, Colo. Over-all length is 2 1/8 in. and body diameter is 1 1/8 in.

Gear ratios available are 15, 10, 9, 8, 7, 6, 5, 4, 3, 2, 3/2, 4/3, 5/4, 6/5, or 10/9 and power may be transmitted in either direction. Speeds as high as 20,000 rpm and torques as much as 2 lb-in. are permissible for some applications. Spur gear construction is used.

•

A-C Voltage Recorders

AS MANY AS 16 a-c voltages on a strip chart is possible through the use of a multiple-point remote indicating voltage recorder. This instrument has been announced by Leeds & Northrup Co, 4934 Stenton Ave, Philadelphia 22, Pa. Standard ranges are available to cover the usual bus, transmission and distribution voltages.

Unusual readability of scale is reported, due to use of a suppressed zero range. That portion of the voltage scale is ignored in which the operator is not interested. The few volts (or kilovolts) which need to be watched are spread across the chart width. The instrument can be either a Micromax or a Speedomax.

•

Mercury Lamp

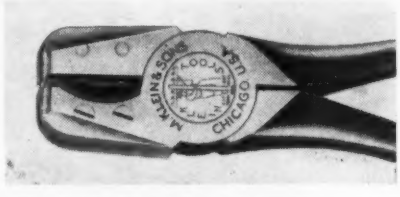
A NEW A-H5 mercury lamp has been announced by General Electric Co, Nela Park, Cleveland, Ohio. It replaces the former A-H5 and C-H5 lamps. Applications are black light, street lighting and general industrial lighting.

The new A-H5 may be used in existing equipment as there is no change required in auxiliary or fixture dimensions. It is reported as rated 250 w, can be burned in any position, and has a maximum outside length of 8 in. Outer envelope is heat resistant glass. This lamp has a lumen-per-watt rating of 45 lumens at 100 hr of life, and reported to burn 2½ times as long as the former AH-5.

•

Coaxial Cutter

DESIGNED for one hand operation, a cutter for coaxial cable has been developed by Mathias Klein & Sons, 3200 Belmont Ave, Chicago 18, Ill. The cutter operates on a shear principle with a convex blade working against a straight blade. It is stated that the



cable end is flattened, thus preventing unwinding of the stainless steel shielding tape on the coaxial tube. The cutter handles both 0.375-in. O D and 0.270 in. O D tubes.

Each cutting blade is held in the tool head by two set screws. Handles are tempered steel drop forgings. Cutter measures 8¾ in. overall.

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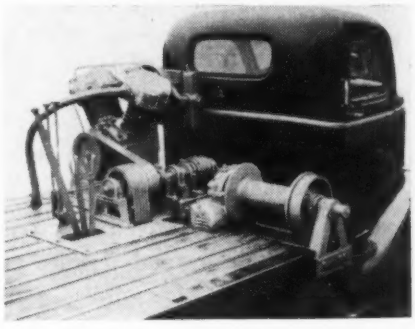
Truck Compressor-Winch



DEVELOPMENT of a new truck-mounted "Auto-Air" compressor-winch assembly is announced by Davey Compressor Co, Kent, Ohio. A power take-off and a counter-shaft with two disk clutches provide for either simultaneous or separate operation of compressor and winch.

Winch is 25,000 lb capacity. Compressor is model 105-VC and is reported to deliver 105 cfm at 100 psi. Unit is 38 in. high and extends 40 in. behind truck cab. Air receiver and double hose reels are mounted beneath the truck platform.

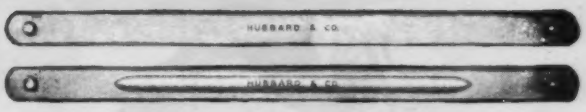
•

Welding Fume Exhauster

A NEW portable fume exhauster for use in welding operations is made available by Mine Safety Appliances Co, Pittsburgh 8, Pa. It is especially suited for operations in cramped, confined quarters or where the welder must

UNSUNG HEROES OF POLE LINE CONSTRUCTION

Simple things, CROSS ARM BRACES, just a strip of flat steel with a hole punched in each end, but most important to a pole line. Hubbard Braces are fabricated from the best, new, open-hearth steel and all corners are rounded to protect linemen from sharp projections. For the engineer who wishes additional strength on the compression side of the arm, the ribbed brace is provided and offers approximately 25% added protection.

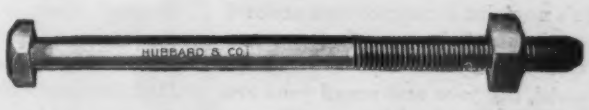


HUBBARD FLAT AND RIBBED CROSS ARM BRACES

HUBBARD ANGLE CROSS ARM BRACES, for heavy construction, are supplied in a range of spreads and drops to meet the requirements of any standard construction. Angle size runs from 1½ to 2-inches. At the pole attachment hole, the angle is so formed that wrench clearance is provided. Attachment is by ⅝-inch Machine Bolt at the pole and ½-inch Carriage Bolts at the arm.

HUBBARD ANGLE CROSS ARM BRACE

DRIVE POINT MACHINE OR CROSS ARM BOLTS are roll-threaded to provide a "finger-fit" for the full length of the thread. The "Drive Point" feature enables the bolt to be used as a drift pin for the alignment of holes slightly off center. This operation must be carried out with caution so as not to injure the threads. "Drive Point" also facilitates the application of nuts and allows bolts to be driven out of the pole for reclamation without injury to the threaded end. The major portion of Hubbard bolts of all types have this feature.



HUBBARD DRIVE-POINT CROSS ARM OR MACHINE BOLT

HUBEYE BOLTS are furnished for attachments of any kind where a thimble would normally be used. The eye of the bolt is drop-forged to a shape which provides a perfect "built in" thimble. Strand may be looped around the Hubeye with complete protection. Side walls of the eye retain the roundness of the strand. There is no possibility of kinks or strains at the loop. Hubeyes are a thoroughly tried and proven product.

HUBEYE DRIVE-POINT BOLT

STANDARD HUBBARD OVAL-EYE BOLTS are an old line item still much used in many sections. Hubbard Eye Bolts are all drop-forged with an eye that is stronger than the shaft of the bolt. Made from the best, new, open-hearth steel and Hubbard Double-Dip Hot Galvanized.

HUBBARD OVAL-EYE DRIVE-POINT BOLT

HUBBARD AND COMPANY

PITTSBURGH
CHICAGO

OAKLAND
CALIF.

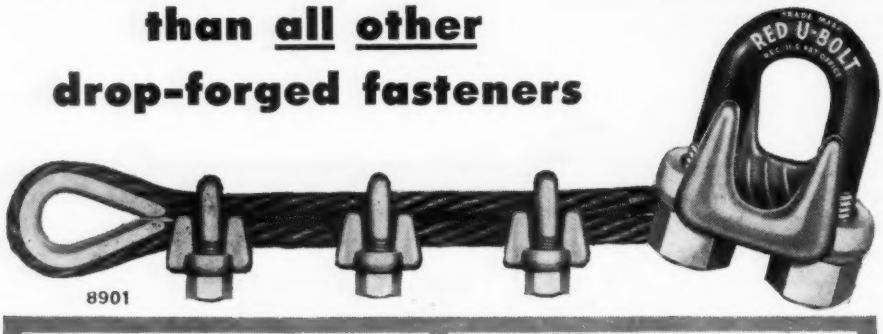
There's no point in monkeying around with makeshift wire rope fasteners, on jobs *where safety comes first.* All over the world, big jobs and small jobs are rigged with genuine CROSBY CLIPS. They're steel, drop-forged, hot dip galvanized. Correct design makes a positive "vise-tight" grip. Complete run of sizes . . . for ⅛ inch to 3 inch wire rope. Distributors everywhere. Made only by AMERICAN HOIST and Derrick Co., St. Paul 1, Minnesota.

Industry uses more

CROSBY CLIPS

than all other

drop-forged fasteners



For Armored Construction . . . specify

AMERICAN BLOCKS AND SHEAVES

● A complete line of wire rope blocks—all types, all sizes, in capacities from 1½ to 250 tons. Thick steel side plates, heavy pins and axles. Ask for American equipment when ordering.

ONE MAN LIFTS 10,000 LBS. WITH THE

AMERICAN HANDIWINCH

● Gives one man the power of a crew. Weighs only 95 lbs. Handles lifting, loading and pulling jobs up to 5 tons. All steel construction. Ask your distributor.

move from place to place in the shop.

The self-contained unit weighs only 25 lb, is 34 in. long and 10 in. in diameter. The suction hose is adjustable and can be held in one hand while the welder works with the other.

In operation, the intake end of the hose is placed approximately 4 in. from the welding arc. The fume-laden air together with slag and sparks is sucked at high speed into the unit where it strikes a curved baffle in the settling or separating chamber and loses over 20 percent of its solid impurities. At reduced velocity, the air then passes through a spark arrester screen into the filter section of the exhauster, which is composed of twelve fire-proofed filter tubes, each 2 in. in diameter and 18 in. long. The tubes are connected to a spring-mounted frame. Fume particles are removed from the tubes at necessary intervals simply by pulling several times on the cord. The unit can be used without removal of particles for at least forty 5/32-in. or twelve ¼-in. rods welded on black iron, or twenty 5/32-in. rods welded on galvanized iron, etc. Suction (80 cfm flow) remains practically constant during the entire operation.

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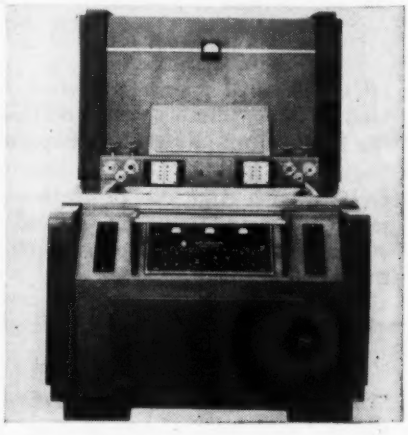
Three H-F Generators

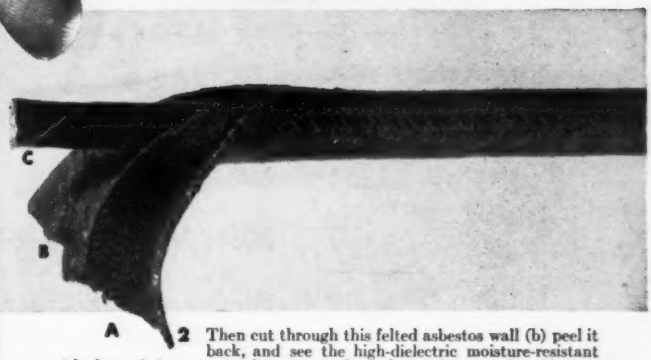
DESIGNED SPECIFICALLY for the metalworking industry, three new 20-kw, 450-kc generators are being built by Westinghouse Electric Corp, East Pittsburgh, Pa. Each consolidates generator, worktable or sink, current



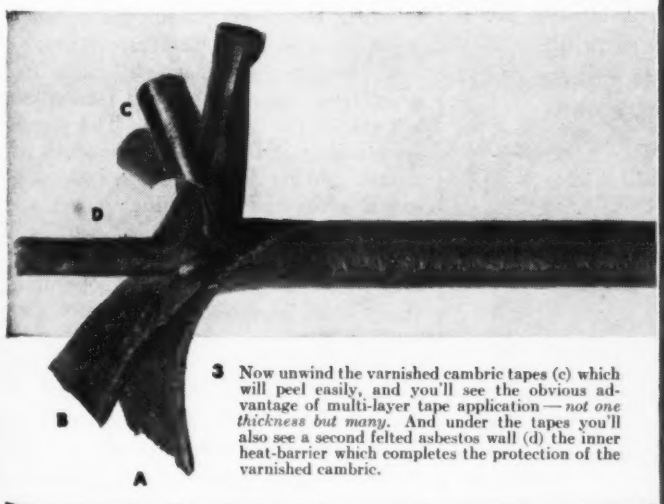
transformers and water fittings into one unit requiring minimum floor space. The three generators are: (1) Type A, a single position unit with built-in worktable and transite table top especially suited to brazing and soldering; (2) Type B, a single position unit for hardening applications with a built-in work sink, two sets of water fittings and a current transformer; and (3) Type C, a versatile two position unit suited to many soldering, brazing, and hardening applications that combines

For Resistance to Heat and Fumes LOOK Beneath the Braid

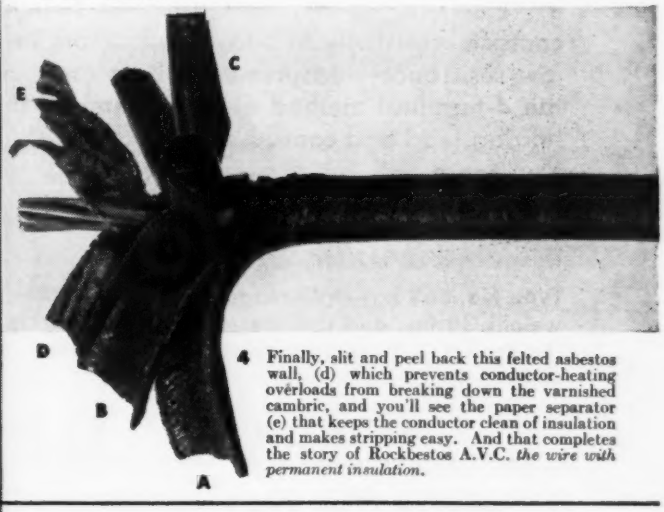
1 Take a sample of Rockbestos A.V.C. Power Cable, illustrated, or similarly insulated Motor Lead Cable, slit open the heavy asbestos braid (a) which is resistant to heat, flame, moisture, oil, and grease, and you'll find beneath a firewall of felted asbestos (b) a permanent heat-barrier against high ambient temperatures.



2 Then cut through this felted asbestos wall (b) peel it back, and see the high-dielectric moisture-resistant varnished cambric tape (c) it protects from heat, flame and oxidation. Notice, too, the uniform coverage of the tapes, helically applied like the felted asbestos to assure perfect and permanent centering of the conductor in the insulation.



3 Now unwind the varnished cambric tapes (c) which will peel easily, and you'll see the obvious advantage of multi-layer tape application — *not one thickness but many.* And under the tapes you'll also see a second felted asbestos wall (d) the inner heat-barrier which completes the protection of the varnished cambric.



4 Finally, slit and peel back this felted asbestos wall, (d) which prevents conductor-heating overloads from breaking down the varnished cambric, and you'll see the paper separator (e) that keeps the conductor clean of insulation and makes stripping easy. And that completes the story of Rockbestos A.V.C. *the wire with permanent insulation.*

A casual inspection isn't enough when it comes to selecting wire and cable for performance in hot-spot service. You've got to look *beneath* the braid! When circuits must operate next to boilers, furnaces, steam lines, drying ovens, resistor grids and soaking pits it is vitally important that the wire is *completely* insulated to withstand heat and moisture, corrosive fumes, oil, grease and flame.

The photos and text above tell the "inside story" of the reasons why Rockbestos A.V.C. Power, Motor Lead and Lighting Wires and Cables (National Electrical Code, Type AVA) will protect circuits and reduce maintenance . . . why their *permanent insulation* makes possible *continuous operation* at 230° F., under varied severe conditions without baking brittle, flowing or rotting.

Send for a sample, look beneath the braid, and see for yourself why Rockbestos A.V.C. gives more service per foot in the worst places. Several types for power, lighting and control circuits, switchboards and equipment, in 600 to 5,000 volt ratings. Just ask for what you are interested in. Write to:

ROCKBESTOS PRODUCTS CORP., 223 Nicoll St., New Haven 4, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

125 different permanently insulated wires, cables and cords

developed by Rockbestos for various severe operating conditions

NEW YORK CHICAGO BUFFALO CLEVELAND DETROIT
PITTSBURGH ST. LOUIS LOS ANGELES OAKLAND, CALIF.

2 NEW SHALLCROSS LOW-RESISTANCE TEST SETS

(Bond Testers)

670C ▶
◀668

Linear Micro-Ohmmeter Models

These new Shallcross instruments permit quick, accurate comparison tests of extremely low resistances between 2 and 800,000 micro-ohms. They are ideally suited for testing electrical bonds, heavy current switch and relay contacts, resistivity of heavy conductors or for making low resistance measurements. Both instruments utilize the 4-terminal method of measurement, thereby minimizing lead and contact resistance.

Type 670-C, a six-range instrument (1,000 to 500,000 micro-ohms) is designed for outdoor or production line work where extreme portability is needed. It weighs only 10 lbs., operates from dry cells. Housed in steel case fitted with carrying strap.

Type No. 668 has eight ranges (200 to 800,000 micro-ohms), weighs 30 lbs. and operates from 115v 60-cycle current. It is the perfect instrument for all research, laboratory or production low-resistance tests.

WRITE FOR BULLETIN LRT-1

describing the complete line of Shallcross Low-Resistance Test Sets.

SHALLCROSS MFG. CO., Dept. EW-18 Collingdale, Pa.

SHALLCROSS

Write for Bulletins on any of these products:

- Accurate Heavy-Duty Power Resistors
- Attenuation Pads
- Attenuators — Fixed and Variable
- Ayrton Universal Shunts
- Bridges, Resistors, Decades, etc.
- DC Instrument Power Supply
- Decibel Meters
- Fault Location Bridges
- FM and Television Sound Components
- H. V. Corona-Protected Resistors
- Kelvin-Wheatstone Bridges
- Kilovoltmeters and K. V. Multipliers
- Logarithmic Decade Boxes
- Low Resistance Test Sets
- Megohm Bridges
- Percent Limit Bridges
- Portable Galvanometers
- Potentiometers — step and slide-wire
- Precision Wire-wound Resistors
- Ratio Arm Boxes
- Rotary Selector Switches
- Standards—Resistance and Decade Boxes
- Telephone Transmission Test Equipment
- Unmounted Resistance Decades
- Voltage Dividers
- Wheatstone Bridges
- Wire-wound Surge Resistors

a built in work sink, two sets of coil and quench water fittings, and two current transformers with automatic transfer switch to provide two independently controlled work positions.

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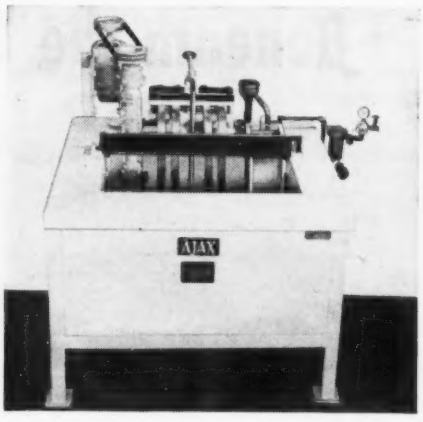
Isothermal Quench Furnace



A NEW DESIGN of the Ajax Hultgren electric salt bath furnace is being offered by Ajax Electric Co, Philadelphia 23, Pa. For use with the Ajax isothermal heat treat process, the quench furnace employs the principles of a heat exchanger to hold the quenching bath at a constant temperature.

A motor-operated, high capacity, submerged pump is provided (shown at left side of the illustration). The pump outlets are stated to subject the work to a fast moving stream of molten salt which gives the quenching power of warm oil.

To eliminate contamination of salt in a two-furnace set-up, a salt separator (right) is immersed directly in the isothermal quench bath. The separator is comprised of a screen filter and an air pump. The precipitate is collected in the screen filter and the clarified quench salt returns to the bath.

The isothermal quench furnace can be heated either by immersed electrodes for high-temperature work, or by immersion heating elements for low-temperature work.

•

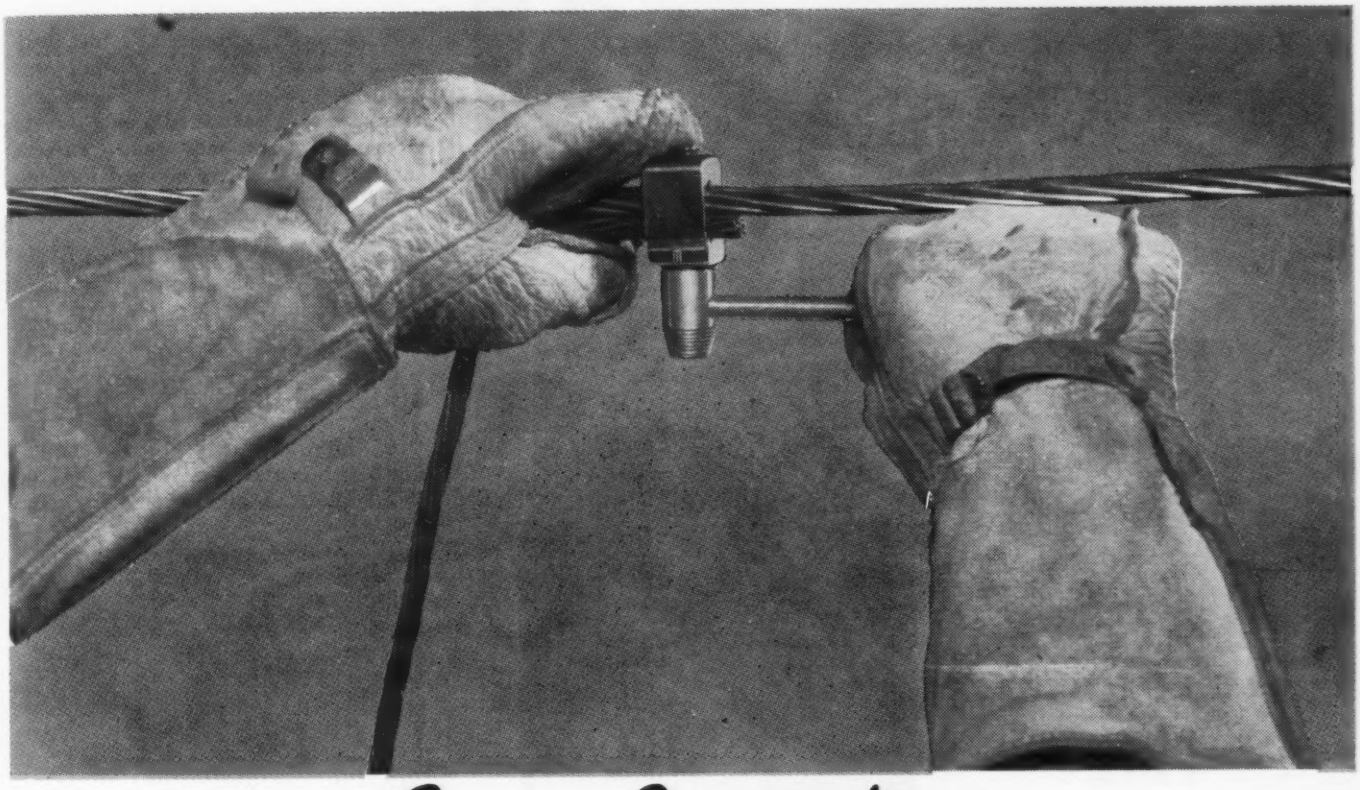
Cartridge Fuses

A NEW LINE of renewable cartridge fuses, designed for shockproof servicing and rapid renewal, has been announced by the Solar Electric Corp, Warren, Pa.

The knife-blade type fuse has only two main parts: a cartridge case with no exposed ferrules or bolts, and a link-blade assembly. One end of this assembly is sealed to an inner collar on the case by a fiber washer backed by a brass plate; on the other end, a threaded brass plug, permanently fas-

Easy to handle...

even with gloves!



Fargo Connectors

ENGINEERS' VIEWPOINT—

The vise type connector is electrically durable. Component parts weather better than copper. On small sizes, total jaw pressure exceeds a half ton—on larger sizes well over a ton. Vibration is no problem with Fargo's vise action.

These characteristics together with timesaving and reusability features all add up to a good, low cost and durable connection.

LINEMEN'S VIEWPOINT—

Linemen often work under handicaps—bad weather—awkward position on poles—close to high voltages and with heavy rubber gloves with protectors. With no threading of parts on a vise type connector, their work, risky at best, is much easier and safer.

They save disposition too, as well as time!

"---grips like a vise."

FARGO **MFG. COMPANY, Inc.**
ESTABLISHED 1914
Poughkeepsie, N. Y.

Full Fargo Line Distributed by
LINE MATERIAL COMPANY
Milwaukee, Wisconsin.
(Representatives in principal cities)

STOP FIRE FASTER

WITH AN

THE MASTER OF FLAME
ANSUL
REG. U.S. PAT. OFF.
FIRE EXTINGUISHING EQUIPMENT

DRY CHEMICAL

FIRE EXTINGUISHER

● FASTER fire-stopping power is your first requirement when fire breaks out... and Ansul Dry Chemical Fire Extinguishers give you that extra margin of protection against major fire damage.

● In addition, you get GREATER fire-stopping power... because Ansul Plus-Fifty Dry Chemical releases its flame smothering gases in the heart of the flames.

● For fires in flammable liquids and in electrical equipment, Ansul Dry Chemical Fire Extinguishers provide greater protection... pound for pound and dollar for dollar than any other extinguisher.

Get the facts. Ask for authoritative comparative ratings as determined by a national approval agency.

MADE BY THE MANUFACTURERS OF ANSUL DRY CHEMICAL FIRE EXTINGUISHERS, MODELS 4, 20, 30, 150-A AND 350-A.

ANSUL CHEMICAL COMPANY
FIRE EXTINGUISHER DIVISION, MARINETTE, WISCONSIN

tened to the knife-blade assembly, screws inside the casing. When blowouts occur, gases, heat and pressure are safely dissipated through a "controlled vent passage" formed between the V-shaped threads of the brass plug and the square-shaped case threads.

The ferrule type fuse is equipped with renewable "timed-lag" fuse-links which give full protection to equipment and wiring against shorts and damaging overloads, yet reduce blowouts due to momentary overloads and current surges. The links are notched for foolproof fitting into correct assembly position.

Solar shockproof renewable cartridge fuses are available in sizes from 3 to 600 amp, 250 or 600 v.

•

Midget Puller

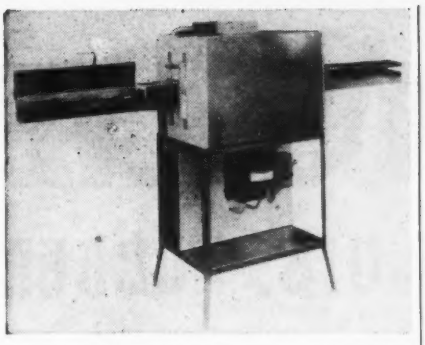
A "MIGHTY MIDGET" puller weighing 6.5 lb is stated to require only 28 lb of effort to pull or lift its rated

capacity of 500 lb. Introduced by the Coffing Hoist Co, Danville, Ill., the portable device features a two-way handle that can be used as a crank or a ratchet lever. Its uses include pulling wire on long span construction, raising messenger cable, shifting heavy dyes and lifting heavy steel plates into position for welding.

•

Tunnel Kiln

FOR SMALL BATCH production work, firing of ceramic parts, and heat treating of small parts on a production basis, a tunnel kiln has been produced by K. H. Huppert Co, 6830 Cottage Grove Ave, Chicago 37, Ill. Having an electric heating element it is reported to provide maximum temperature of 2200 F. The new kiln is the pusher type, with small refractory trays being pushed through the inside of the 33-in. firing chamber by means of a variable-speed drive. The firing zone is 10 in. long, and the size of the tray is 2⅝ in. by 3¾ in. Pusher mechanism as well as provision for loading



and unloading is self-contained within.

The unit's weight is 700 lb. It is equipped with a No. 221 Wheelco Capacitrol for automatic temperature control, fused switch box and step-down power transformer. Power consumption is 2 kw on single-phase, 110-220-v supply. Over-all dimensions are 102 in. long, 62 in. high and 24 in. wide.

•

Fused Switches

A REDESIGNED LINE of fuse puller switches, rated at 60 amp, 125/250 v. a-c and measuring 9⅛ in. wide by 14 in. high by 3⅞ in. deep, has been announced by the Trumbull Electric Manufacturing Co of Plainville, Conn. Four different units are available; two contain four branch circuits, one main, one range circuit and one water heater connection; and two units contain six branch circuits, one main, one range circuit and one water heater connection. The units are wired either in series or parallel. Solderless lugs are provided for wires ranging from No. 14 to No. 4 for the main, range and water heater connections.

A dead front metal shield covers all live parts. "Off" and "On" positions are indicated on the fuse caps. The switches have non-interchangeable range and main caps. The main and range circuits take NEC cartridge fuses and the branch circuits take standard plug fuses. The device is equipped with a grounded neutral.

•

Liquid Level Gage

A LIQUID LEVEL gage made by The Boston Auto Gage Co, Pittsfield, Mass., is provided with a leak-proof magnetic coupling. The coupling consists of two G-E alnico 2 permanent magnets separated by an aluminum diaphragm.

Designed to indicate accurately the level of the insulating liquid in a transformer, the gage utilizes a float inside the transformer tank to transmit the motion of the liquid to one of the alnico magnets. This magnet in turn transfers its motion by magnetic flux to a similar magnet placed on the other side of an aluminum diaphragm and attached to a

North • East • South • West . . . It's Schramm

. . . doing jobs like these in Your Field

At almost every turn you need compressed air!

The check list (at right) indicates some of the many compressed air jobs to be done, all of which are accomplished easily, quickly and economically with Schramm Air Compressors.

Here's *why* you profit, as others have, by using Schramm: they're compact, lightweight, easy to start; built for rugged jobs, to provide a continuous flow of air.

Important features include 100% water cooled; mechanical intake valve; forced feed lubrication and easy, electric push-button starting.

Performance everywhere has proved Schramm Air Compressors can do any compressed air job you require. Write today for list of models and sizes.

- Rock Drilling
- Breaking Pavement
- Trench Digging
- Clay Spading
- Sheet Pile Driving
- Backfill Tamping
- Caulking Pipe Lines
- Spray Painting
- Sand Blasting
- Digging Post Holes
- Pneumatic Grease Guns
- Pneumatic Tools
- Spraying Metal
- Spraying Enamel
- Riveting
- Steel Drilling
- Wood Boring
- Scaling
- Chipping
- Caulking Boilers
- Cleaning Boiler Flues
- Cleaning Engine Generators
- Operating Air Hoists

SCHRAMM INC.

THE COMPRESSOR PEOPLE • WEST CHESTER • PENNSYLVANIA

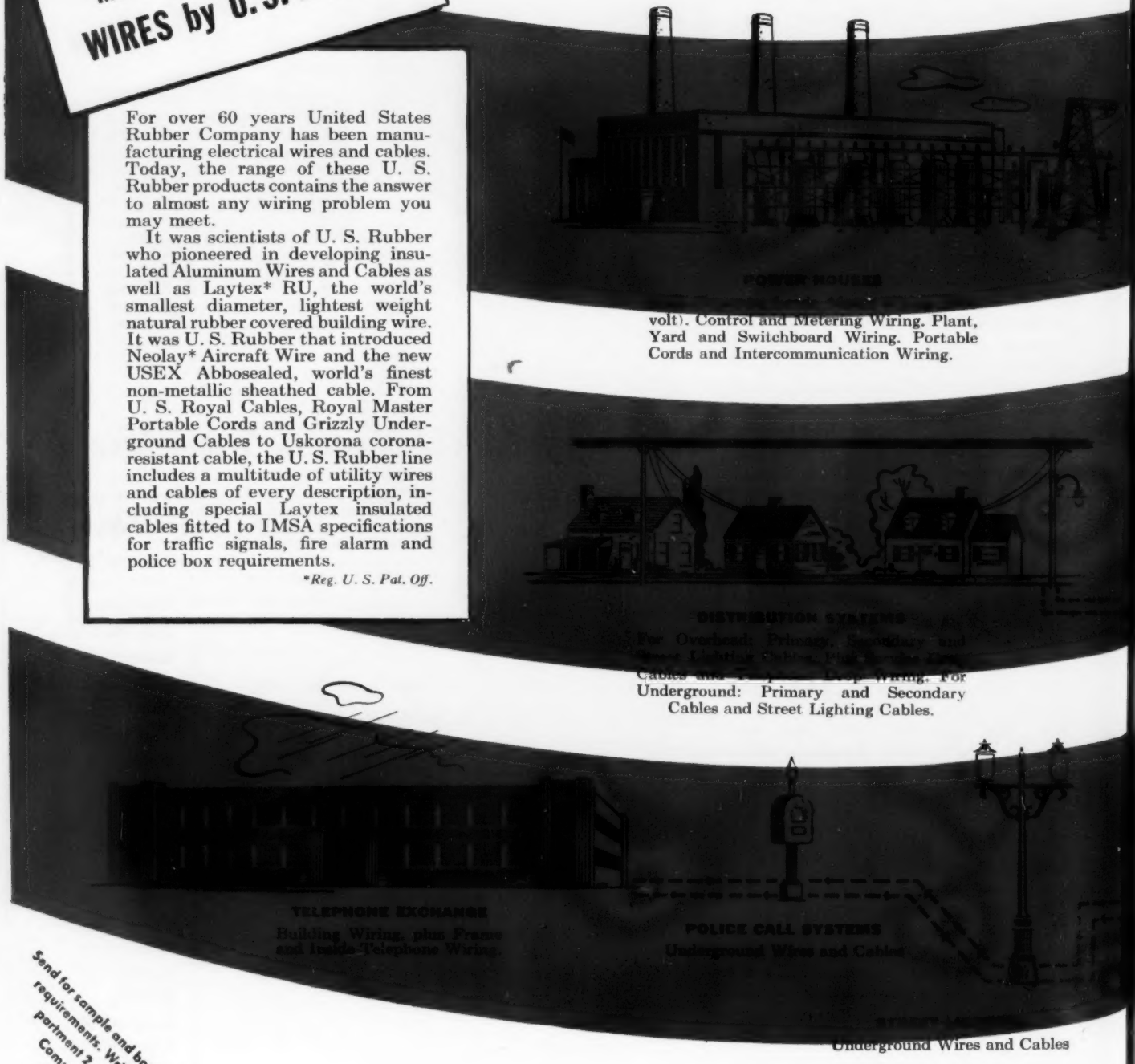
YOU CAN SOLVE
WITH U.S. RUBBER

MORE POWER THROUGH WIRES by U.S. RUBBER

For over 60 years United States Rubber Company has been manufacturing electrical wires and cables. Today, the range of these U. S. Rubber products contains the answer to almost any wiring problem you may meet.

It was scientists of U. S. Rubber who pioneered in developing insulated Aluminum Wires and Cables as well as Laytex* RU, the world's smallest diameter, lightest weight natural rubber covered building wire. It was U. S. Rubber that introduced Neolay* Aircraft Wire and the new USEX Abbosealed, world's finest non-metallic sheathed cable. From U. S. Royal Cables, Royal Master Portable Cords and Grizzly Underground Cables to Uskorona corona-resistant cable, the U. S. Rubber line includes a multitude of utility wires and cables of every description, including special Laytex insulated cables fitted to IMSA specifications for traffic signals, fire alarm and police box requirements.

Reg. U. S. Pat. Off.

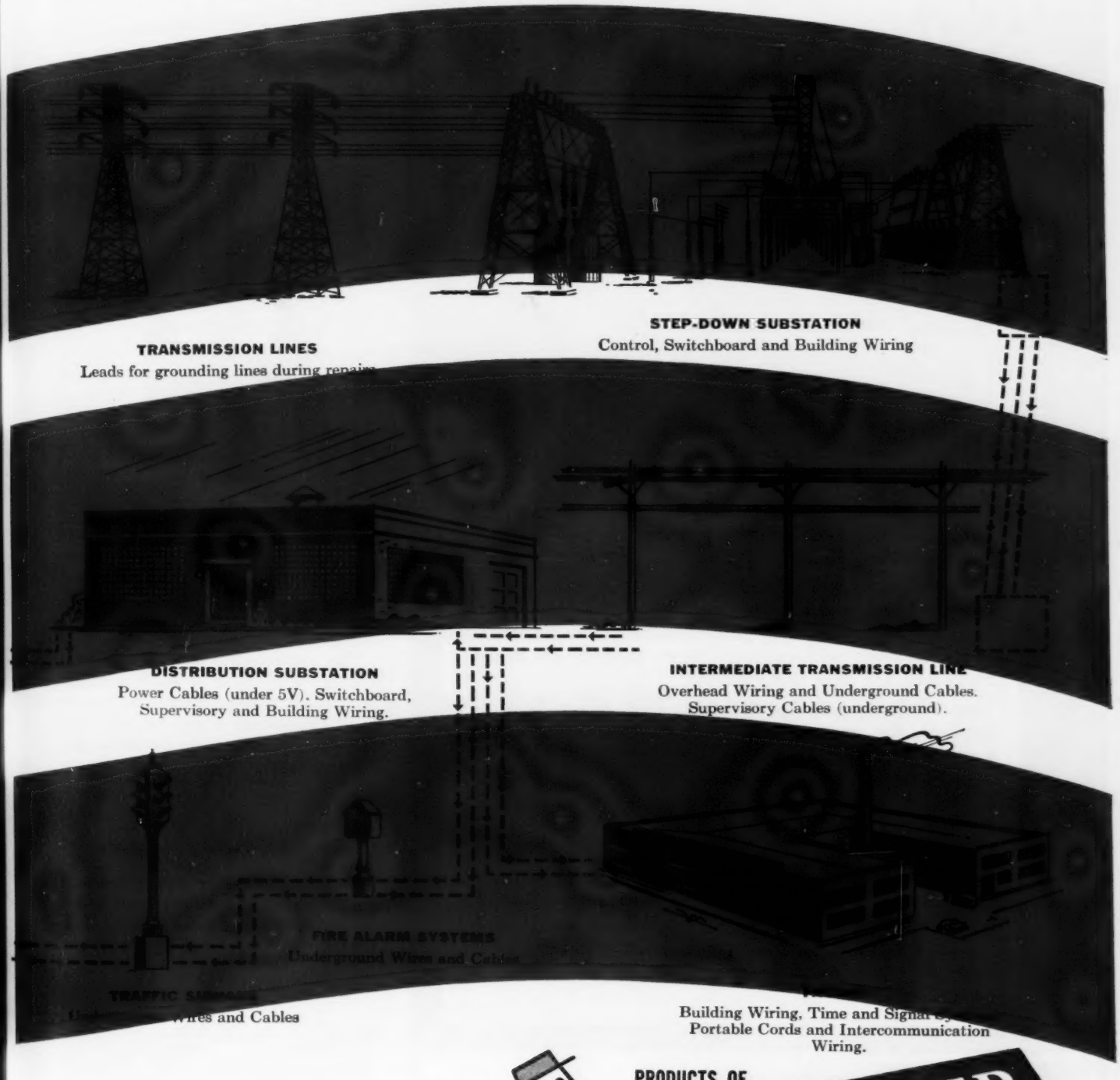

POWER HOUSES
volt). Control and Metering Wiring. Plant, Yard and Switchboard Wiring. Portable Cords and Intercommunication Wiring.
DISTRIBUTION SYSTEMS
Underground: Primary and Secondary Cables and Street Lighting Cables.
TELEPHONE EXCHANGE
Building Wiring, plus Frame and Inside-Telephone Wiring.
POLICE CALL SYSTEMS
Underground Wires and Cables
Underground Wires and Cables

Send for sample and booklet on your particular requirements. Write Wire and Cable Department 2, United States Rubber Company, 1230 Avenue of the Americas, New York 20, N. Y.

SIXTY YEARS OF WIRE

ANY POWER PUZZLE

ELECTRICAL WIRES AND CABLES


TRANSMISSION LINES
Leads for grounding lines during repair
STEP-DOWN SUBSTATION
Control, Switchboard and Building Wiring
DISTRIBUTION SUBSTATION
Power Cables (under 5V). Switchboard, Supervisory and Building Wiring.
INTERMEDIATE TRANSMISSION LINE
Overhead Wiring and Underground Cables. Supervisory Cables (underground).
FIRE ALARM SYSTEMS
Underground Wires and Cables
Wires and Cables
Building Wiring, Time and Signal
Portable Cords and Intercommunication Wiring.

PRODUCTS OF

U.S.RUBBER

SERVING THROUGH SCIENCE

UNITED STATES RUBBER COMPANY

SERVICE

Look to Locke for Distribution Materials...

for instance...

This is a Locke No. 0611-44 wireholder — one of a complete line—for installing secondary circuits on poles and buildings.

The hardware is accurately formed to fit the porcelain, and has *Permazinc*—Locke's *Quality Controlled* double hot-dip galvanizing—for extra years of dependable performance. Screw threads are sharp and clean for easy installation.

The wireholder is so designed that, when load is applied, the porcelain is in compression for maximum strength. Porcelain is *Compression Glazed* —an original Locke process—for added strength. Hardware and porcelain are designed together and made together to work together.

Complete lines of distribution materials are maintained in six Locke regional warehouses and in most distributors' stocks. Get in touch with your Locke representative.

Depend on Locke for *Quality Controlled* distribution materials—pole line hardware and insulators. *One* order covers *both*.

Locke POLE LINE HARDWARE and INSULATORS

LOCKE INSULATOR CORPORATION • BALTIMORE 3, MD.

dial indicator needle on the gage.

The aluminum diaphragm is reported pressure tight to a minimum of 30 psi effecting a permanent seal between the liquid and the gage proper. To effect a seal in the opening where the gage is installed, the gage flange is mounted with four studs to the side of the tank, usually below the maximum oil level and is then sealed by a Hy-car gasket.

•

Excess-Smoke Indicator

FOR PRECISION in combustion control, a Type 2A10C excess-smoke indicator has been introduced by Photoswitch, Inc, 77 Broadway, Cambridge 42, Mass. It is designed to give a continous indi-

cation of the condition of the gases which are passing through the flue. Also, at signals when either smoke or air are sufficiently excessive to cause inefficient combustion or create a smoke nuisance.

The photoelectric control and light source are mounted at small openings on opposite sides of the flue or breaching. Combustion conditions are indicated by the densometer located in the boiler room.

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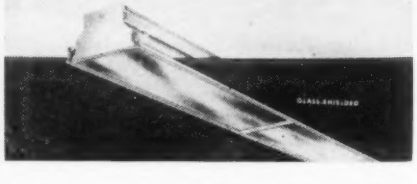
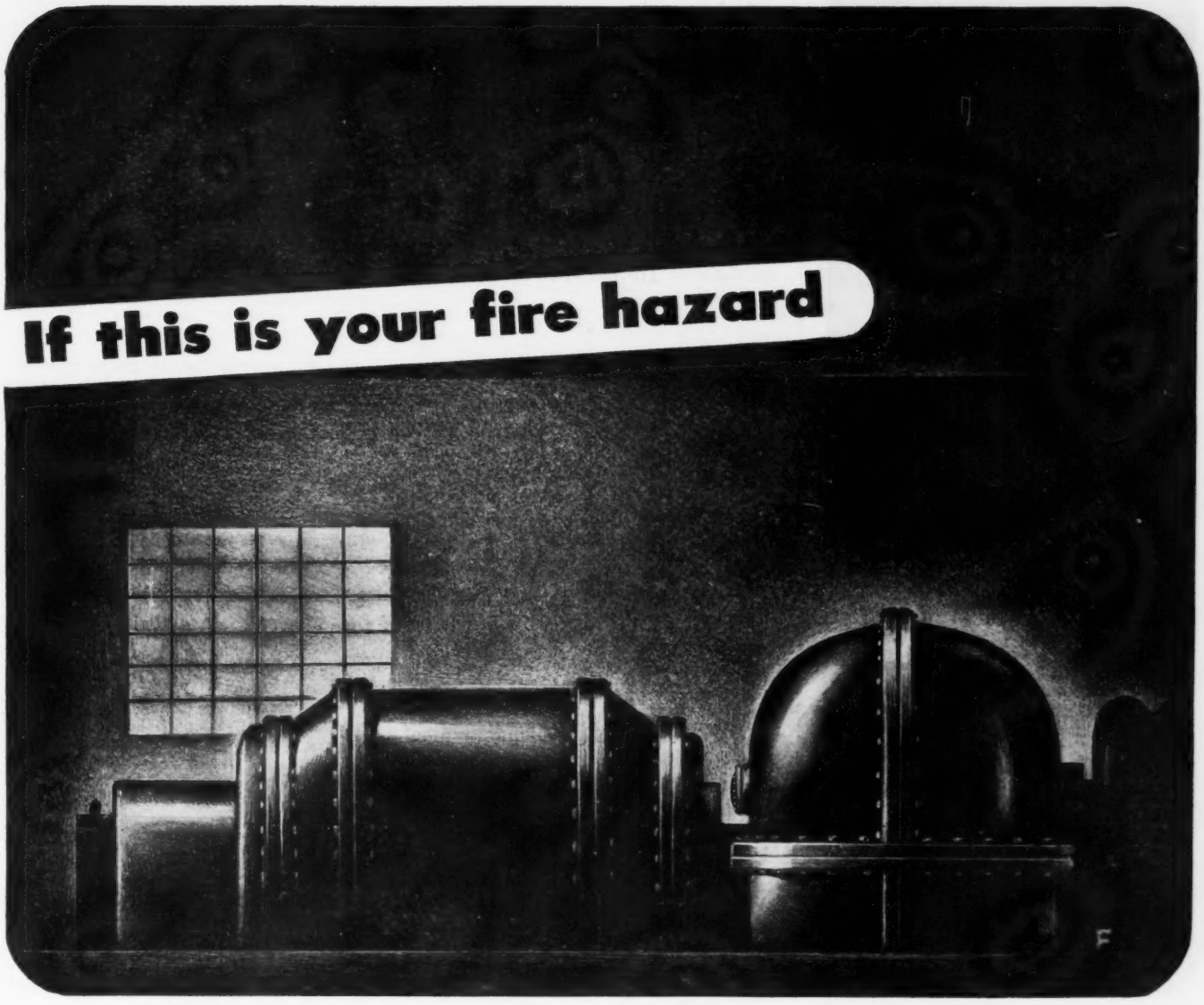
Recessed Troffer System

A NEW FLUORESCENT troffer recessed lighting system has been announced by Mitchell Manufacturing Co, 2525 Clybourn Ave, Chicago 14, Ill. Basic



troffer unit is available with two 40-w, two 40-w with instant start, and three 40-w fluorescent lamps. This basic unit may be used as an open-type, as a glass-shielded type, or a louver-shielded type. Continuous row or indi-



—here's how to SAFEGUARD it!

APPLY CARBON DIOXIDE WITH A KIDDE BUILT-IN SYSTEM

The *Kidde* system feeds a heavy initial discharge of carbon dioxide (CO_2) right into the recirculating ventilating system of a rotating machine—to kill flames.

Additional carbon dioxide during the run-down period maintains an inert atmosphere—prevents glow from rekindling.

Method of operation? Manual or automatic, by means of thermal devices or differential relays.

Easily-installed automatic dampers adapt system to non-recirculating ventilation systems.

Remember . . . CO_2 is dry, inert, non-conducting, clean.

Plan this protection now for your new rotating machinery—install it on your present equipment. A Kidde representative will give you full details.

Kidde

FIRE PROTECTION HEADQUARTERS

The word "Kidde" and the Kidde seal are trade-marks of Walter Kidde & Company, Inc.

Walter Kidde & Company, Inc.
130 Main Street, Belleville 9, N. J.

At this Point...
Listed by Underwriters Laboratories, Inc., and Factory Mutual Laboratories
BLAW-KNOX
Aquatomic
FOG NOZZLES
DO NOT FAIL!
Wide clear passages through the heart of this dependable Fog Nozzle makes it virtually non-clogging—always reliable.
It fights fire with the water available—maintains its fog pattern under low pressures in emergency.
Fine but forceful fog gives maximum cooling and quenching effect and drives to the base of the fire in spite of drafts and turbulence.
Also—
Blaw-Knox offers Standard Wet and Dry Pipe Systems, as well as Thermostatically Controlled Pre-Action and Deluge Systems.
Write for details.
BLAW-KNOX
SPRINKLER DIVISION
of BLAW-KNOX CONSTRUCTION CO.
829 Beaver Avenue, N.S.,
Pittsburgh 12, Penna.

vidual mounting can be made in any type ceiling.

The basic troffer unit consists of reflector and wireway channel wired with ballasts and starters, finished in hard white baked enamel. Formed edges of the basic unit snap into place on the tee-bar on ceilings. Accessory fittings are used for other types of ceilings. The unit measures 45 in. long, 12 in. wide, 7⅜ in. deep, and operates on 110-120 v, 60 cycles.

•

Telephone Test Set

TO FACILITATE tests on electrical installations the United States Instrument Corp, Summit, N. J., announces a new two-way sound powered telephone system. Essentially it is a handset equipped with convenient test clips at the cord tips.

Communication is reported possible without the aid of any external power supply or batteries and is suitable for purposes such as testing pairs, sorting cables, installing, checking, testing for short circuits, and identifying grounds.

The handset is light and waterproof and can be carried under the belt. When not in use for test purposes, the handsets may be used where communication is desired between two remote locations.

TECHNICAL LITERATURE

Vibrators—"Vibrator Data Book" published by P. R. Mallory & Co, Inc, Indianapolis, Ind., price $1. It describes basic structures, designs and characteristics; also discusses selection, outlines applications, describes and illustrates circuits involved and covers inspection procedure.

Electrical Steel—For flat rolled electrical steel, definitions, manufacturing processes, types, magnetic properties, manufacturing practices, testing, are presented in a 102-page book. The publication is Section 26 of the Steel Products Manual and is available from American Iron and Steel Institute, 350 Fifth Ave, New York 1, N. Y.

Aluminum Alloys—"Manual of Aluminum Casting Alloys" contains data on physical and mechanical properties of various sand and permanent mold aluminum alloys; properties of specific alloys; foundry practice; and heat treatment. The 78-page publication may be obtained when requested on your company's letterhead; address Aluminum Research Institute, 111 West Washington St, Chicago 2, Ill.

Air Conditioning — Design load factors, sunlight radiation through glass, ventilation and infiltration, design occupancy and air distribution are some of the items covered in a 16-page booklet entitled "Application Engineering Standards for Air Conditioning for Comfort." These industry standards, price $1, were published by Air Conditioning and Refrigerating Machinery Association, Southern Building, Washington 5, D. C.

Product Developments—Significant equipment and process developments by the Allis-Chalmers Manufacturing Co are presented in its publication, "Annual Review, 1946," obtainable from the company, Box 512, Milwaukee 1, Wis. Some subects include power generation, power distribution, metals, construction and public works, general industrial, and research.

Aircraft Systems—"Report on Aircraft Electric System Guide," publication No. 750, has been issued by the American Institute of Electrical Engineers, 33 west 39th St., New York 18, N. Y. Subjects included cover purpose and requirements of the electric system, general considerations, power equipment and control and protective equipment characteristics, system considerations, definitions and working standards. As the publication is a "Report," printed for the purpose of securing comments resulting from its use, there is no charge for it.

Aircraft Apparatus—"Standard for Aircraft Direct-Current Apparatus Voltage Ratings" is publication No. 700, July, 1947, issued by the American Institute of Electrical Engineers, 33 West 39th St, New York 18, N. Y.; price 20 cents per copy. For nominal system designations of 12, 24 and 120 volts, the rated voltage and voltage adjustment range is given for generators, continuous duty, intermittent duty, and battery operated devices, also voltage for dielectric tests and field tests.

Electrical Units — Announcement of changes in electrical and photometric units is made in a National Bureau of Standards publication C-459 obtainable at 5 cents per copy from Superintendent of Documents, Government Printing Office, Washington 25, D. C. A short account is given of the development of new international agreements on practical units of electricity and of light derived from the fundamental mechanical units of length, mass and time.

Illumination—"The Specification of Illumination and Color in Industry" is a 12-page pamphlet reprinted from the Transactions American Academy of Ophthalmology and Otolaryngology and available from the author, Faber Birren, 500 Fifth Ave, New York, N. Y. It outlines a series of elementary principles for color and brightness specifications.

Standards—"Introduction to AIEE Standards," publication No. 1, June, 1947, is available from the American Institute of Electrical Engineers, 33 West 39th St, New York 18, N. Y.; price 40 cents per copy. It covers the general principles upon which temperature limits are based in the rating of electrical machines and apparatus.

Instruments—"Standard for Electric Recording Instruments" is publication No. 40, July, 1947, issued by the American Institute of Electrical Engineers, 33 West 39th St, New York 18, N. Y.; price 30 cents per copy. The standards include definitions, rating, heating, characteristics of influence of operating conditions, dielectric tests, insulation, resistance and construction for direct-current and/or alternating-current instruments such as ammeters, voltmeters, wattmeters, varmeters, frequency meters, power factor meters, ohmmeters and temperature recorders.

Resistance Measurement—Test code has been developed to give instructions for those measurements of electric resistance which are commonly needed in determining the performance characteristics of electric machinery and equipment. Methods in general are limited to those using direct-current or commercial power frequencies. Publication 550, "Master Test Code for Resistance Measurement," can be obtained from American Institute of Electrical Engineers, 33 West 39th St, New York 18, N. Y.

NEWS ABOUT PEOPLE

Florida Power Corp Elects G. A. Grimm Vice-President

Announcement has been made of the election of George A. Grimm as vice-president of the Florida Power Corp., St. Petersburg. Mr. Grimm joined the staff of the utility company early in 1946 to take charge of the transmission, distribution, engineering and production departments. At that time he had just returned from Japan, where he held the rank of colonel in the U. S. Strategic Bomb Survey group. He had previously served as head of the power division in the Office of War Utilities of WPB. In this position he headed utility survey parties that visited major power plants in France, England, Germany, India, Mexico and other countries.

G. A. GRIMM

Starting with the Commonwealth Edison Co in 1922, he moved 5 years later to the Indiana Service Corp at Fort Wayne as chief load dispatcher. He also did customer service work and some supervision of operations. It was from this connection that he went to WPB in 1942.

•

▶W. L. JONES, formerly treasurer of the St. Louis County Gas Co, has been appointed director of a newly organized department for economic development in the Union Electric Co. Mr Jones has been associated with Union Electric for 27 years, first in the sales department, then as local manager at De Soto and St. Charles and finally with the St. Louis County Division. He held positions as sales manager of the county division, treasurer of St. Louis County Gas, (which at the time was associated with Union Electric) and subsequently as assistant treasurer of Union Electric.

•

Directs Branch Sales, Wire Cable Unit, U. S. Rubber

Announcement has been made by the wire and cable department of the U. S. Rubber Co of the appointment of Frederick P. Combier as manager of branch sales.

Mr Combier is widely known in the electrical industry where he has held several national sales management positions. For many years he was vice-president and sales manager of the Fibre Conduit Co of Orangeburg, N. Y. He has also been vice-president and sales manager of Hunter Douglas Corp., machinery manufacturers; Circle F Mfg. Co, wiring devices and specialties; and Robeson-Rochester Corp., appliances. He was one of the original members of the Hotpoint sales organization, serving as salesman, district sales manager and then managing director of the Canadian company.

F. P. COMBIER

In his new position, Mr Combier will supervise 29 branches, and will also direct the company's new conductive rubber heating panels.

Hamilton and Ewald Get New Engineering Assignments

A. H. Hamilton, formerly general superintendent of distribution and construction, Northern States Power Co, Minneapolis, Minn., has been named construction assistant to the first vice-president, H. C. Cummins. Earl Ewald, distribution office, has been appointed general superintendent of electric distribution, assuming Mr Hamilton's former duties as related to supervision of transmission and distribution functions of the electrical operations department.

A. H. HAMILTON

Mr Hamilton started with the company in 1915 in the special construction department. In 1940, he was made general superintendent of construction and in 1943, he was appointed general superintendent of distribution and con-

E. EWALD

For more than 45 years the famous STEPHENS Climbers have been exclusively manufactured by

Buckingham

of Binghamton

and in that time one objective has been constantly kept in mind—to maintain the same high quality standards established by Wilmot Stephens when he first forged climbers on a blacksmith's anvil almost a half century ago.

Extreme care is taken to provide safe, comfortable equipment, and every article is inspected to comply with the exacting requirements established by safety engineers.

Buckingham "Cushion Deluxe" Floating Tool Belt No. 58 is made from the best latigo and chrome leathers. It has the "rolled edge" feature that gives a cushion effect with the greatest comfort to the wearer. Rigidly tested for strength and safety.

Here's Why Buckingham Climbers are Safer — More Comfortable!

- Shank a perfect fit, shaped for comfort.
- Wide standing surface slightly rounded to fit foot.
- Round loop will not cut straps.
- Gaff is hammer-forged from special tool steel, set straight with body of climber and close to foot-piece, giving least strain to climber, and maximum comfort to lineman.
- Each climber tested for toughness and strength of gaff rivet.
- Each climber Parkerized (rust proofed) and lacquered.

BUCKINGHAM MANUFACTURING CO., INC.

Walter E. Craw, President 5-7 Travis Street, Binghamton, N. Y.

See your distributor NOW. More than 400 outlets handling Buckingham equipment

struction. A few months later, he left the construction office to take direct charge of the electric distribution department.

Mr Ewald became identified with Northern States in 1930 and after completing the Cadet Engineers' Training Course the following year, he was assigned to the distribution department where he remained until his transfer to the engineering department upon its organization in 1936. He returned to the distribution department in 1945.

•

R. C. Hienton Appointed Industrial Sales Manager

R. C. Hienton, director of the development division of the Cleveland Electric Illuminating Co, has been appointed industrial sales manager of

R. C. HIENTON

the company. As director of the development division, Mr Hienton has been a key figure in the campaign to encourage business and industry to locate or expand in Cleveland-Northeast Ohio. He will continue to direct the company's development division. Mr Hienton has been in the sales department of the Cleveland utility for 20 years.

At the same time the appointment of H. A. Lawrence as commercial sales manager was announced. Mr Lawrence joined the company in 1924 and has been supervisor of commercial sales since 1946.

•

▶ HOWARD J. SCAIFE has been appointed manager of market development and WILLIAM F. OGDEN manager of product planning of Hotpoint, Inc, Chicago, both newly created positions. The market development position was designed to "emphasize the development of specialized markets, and to keep abreast of changes in marketing brought about by the increased importance of electrical

COMMUNITY CENTER

The McCarthy Center, now under construction in Houston, Texas, will comprise the 18-story Shamrock Hotel; a garage to house 1,275 cars; a shopping center of several buildings; a theatre seating 1,750, complete with concert stage; a 50-meter swimming pool; and a 15-acre parking lot.

Stone & Webster Engineering Corporation are the project managers for the construction of this comprehensive community center.

WYATT C. HEDRICK, ARCHITECT

STONE & WEBSTER ENGINEERING CORPORATION

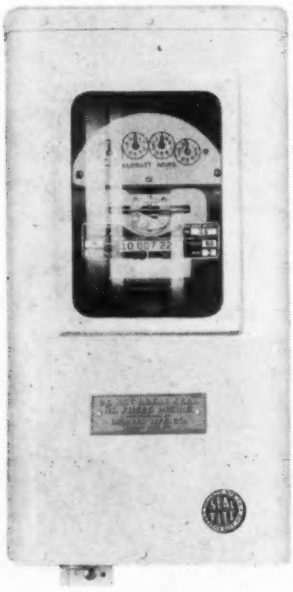
A SUBSIDIARY OF STONE & WEBSTER, INC.

MILBANK
Aluminum
"SEAL-TITE"
METER ENCLOSURES

★ *Lightweight,*

★ **Rugged and**

★ **TAMPERPROOF**



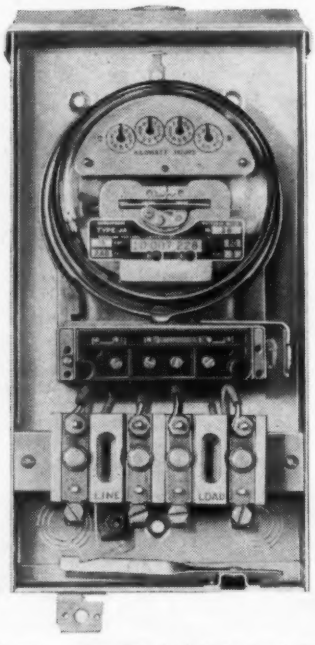
Designed in every detail to serve the utilities' needs, *new* Milbank Aluminum "Seal-Tite" single phase enclosures give you the ultimate in long-wearing, smartly-styled outdoor meter enclosures.

Fabricated from heavy-gauge, durable, non-corroding aluminum—Milbank meter enclosures are seamless and weatherproof. Made from die formed, perfect fitting parts, they are the complete answer to your outdoor meter "housing" problems.

Milbank's "Seal-Tite" feature is invaluable in preventing tampering. The enclosure lock is protected with a combination glass-decalcomania seal that *cannot be faked once it is broken.* The only way a Milbank meter enclosure can be entered is to break the glass, and this immediately gives evidence of tampering.

Outdoor metering saves time in reading, improves customer good-will. When you next purchase out-door meter enclosures, investigate Milbank "Seal-Tite" enclosures for superior features and trouble-free service.

- Never cause rust streaks on buildings.
- Spot welded throughout.
- Equipped with extra heavy solderless ground clamp.
- Adjustable test block mounting bridge.
- Double-strength glass windows.



Write today for complete information, catalog and prices.

MILBANK MANUFACTURING COMPANY
411-13 WEST 10TH ST. • KANSAS CITY 6, MO.

living to the post-war consumer." Mr Ogden will be responsible for the coordination of product planning with marketing and merchandising plans and the development of products from the marketing department phase. He went to Hotpoint in 1936 from the Georgia Power Co and since that time has served as commercial engineer and more recently as assistant chief engineer. Mr Scaife was associated with the General Electric Co in various capacities from 1932 until 1936, when he was transferred to Hotpoint as assistant sales manager of refrigeration. In 1944 he was named western regional sales manager.

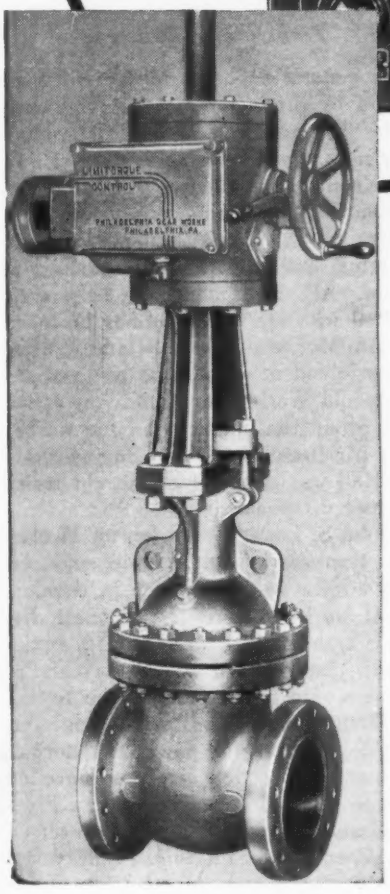
•

General Electric Makes New Engineering Appointments

Major appointments have been announced in the control divisions of the General Electric Co's apparatus department. M. H. Blesh has been named manager of manufacturing, C. B. Bradish, manager of engineering, and E. A. Green, manager of sales. Mr Blesh joined GE in 1928 and entered the control division in 1934. Entering the employ of the company in 1912, Mr Bradish joined the general consulting laboratory the following year, working under the late Dr C. P. Steinmetz. A few months later he was transferred to what is now the control divisions. Since becoming identified with GE in 1924, Mr Green has had a wide variety of engineering experience, in industrial engineering divisions, motor divisions, priorities committee, and in the production manager's office during World War II; since then, in the motors divisions and the industrial divisions.

Four other recent appointments in the apparatus department include: W. V. O'Brien, named assistant general manager of sales; R. M. Darrin of New York, manager of central station divisions, succeeding Mr O'Brien; J. C. Miller, assistant to the manager of sales; and H. P. Bish, manager of aircraft, federal and marine divisions. After serving many years with GE in the southeast, Mr O'Brien went to Schenectady in 1937 entering the central station division. Subsequently he joined the lighting and cable division and then the central station divisions of which he was made manager in 1945. Since joining GE in 1919, Mr Darrin has served in Pittsfield, Buffalo and Syracuse and more recently in New York as assistant district manager of the central station divisions. Mr Miller has been with GE since 1927 and Mr Bish since 1919. As manager of the aviation division of the industrial divisions Mr Miller had responsibility for coordinating the company's aviation activities with

Push-Button CONTROL OF VALVES WITH Limitorque VALVE OPERATOR



The "Limitorque" (at left) is for valves working at low to medium temperatures, low to high pressures, and normal speed of operation.

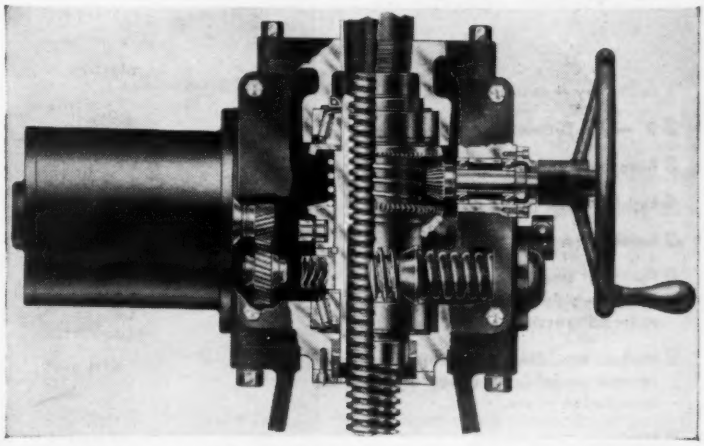
This Unit is mounted on top of valve yoke . . . no extra gears, nuts or bearings required. Stem nut is inside and furnished with Unit. Nut is directly inside worm gear which drives it. (All clutches and connecting sleeves are eliminated.)

Limitorque is designed for plug, cock, gate and globe valves . . . Entire Unit and nut can be lifted off valve yoke, by removing flange bolts, without disturbing wiring.

A special high starting torque motor, reduction gears, limit switches all in one weatherproof assembly—and all electrical connections are made to one terminal board, easily accessible by removal of watertight cover. . . . Heat treated helical gears and hardened, ground and polished worm and bronze worm gear are used.

A handwheel is provided for manual operation and does not revolve during motor operation. During hand operation motor is mechanically disengaged. Limitorque is always operative electrically. No danger to operator should he be turning handwheel when motor is started, since automatic clutch disengages handwheel instantly, without shock. Declutch lever changes from motor to hand operation. The usual Limitorque "hammerblow" device allows motor to reach full speed before load is engaged. This imparts the "hammerblow" necessary to unseat sticking valve.

Torque seating switch insures tight valve closure without strain on valve parts. Protection from damage due to a foreign object obstructing closing is provided, because motor is shut off by thrust exerted on valve disc. Valve is protected during entire closing operation.



The word "Limitorque" has a definite meaning because an exclusive patented Torque Switch actually limits the torque applied to the operating parts.

FEATURES OF THE "SM" TYPE LIMITORQUE

1. Micrometer torque seating switch.
2. Self-contained unit—no gears, nut or bearings to buy.
3. Weatherproof, dust-tight and watertight construction.
4. Hammerblow device.
5. Non-rotating handwheel built into the unit.
6. Automatic declutching.
7. One terminal board for all electrical connections.
8. High torque motors.
9. Simple valve yoke.

Motor is coupled to worm shaft through helical gears. In closing, worm drives worm gear until lugs on the gear meet matching lugs on clutch. Torque is transmitted to the nut through splines connecting the clutch to stem nut. Torque spring is then compressed by axial movement of worm on worm shaft. When torque spring has been compressed to predetermined setting, torque switch is actuated by a tripping collar on worm shaft. This interrupts current to holding coil of controller and stops motor. Inertia of motor is absorbed in further compression of the torque spring. Opening travel is governed by geared limit switch.

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The Versatility-Efficiency and economy of electric power is demonstrated by the use of the light — multi purpose and flexible

KA-MO TOOLS

• In addition to being able to bore dry — straight holes in any type earth and in any direction, it is possible at the same time to use saws — impact wrenches — flood lights — soldering irons — brush cutters — drills etc.

OUR EQUIPMENT IS NOT A ONE PURPOSE TOOL

VERTICAL DRILLING

1 Fast—light—portable for drilling in any location—over fences—ditches etc.

2 17" diameter maximum—any depth up to solid rock.

3 Does not tie up truck in any way.

4 Drills a straight and to—size hole.

5 Anchor holes are no problem.

6 Slip clutch assures safe operations.

7 Simplicity makes for low maintenance.

8 Used for pole line work — testing soil — billboard work — elevator shafts—fences—preboring for piling — etc.

9 The low cost makes for a greater spread of drilling equipment.

1 Drills dry — straight holes.

2 3"—17" Diameter to any length.

3 Bores are rapidly made.

4 Light weight for easy handling.

5 Safety is an important feature.

6 For use under lawns — streets — alleys — sidewalks — driveways — railroad crossings — etc.

7 Makes an ideal bore for pipe — conduit — cable — street lighting installation — etc.

8 Minimum investment.

Let us tell you of the new KA-MO method for the rapid insertion of pipe up to and including 2" pipe size.

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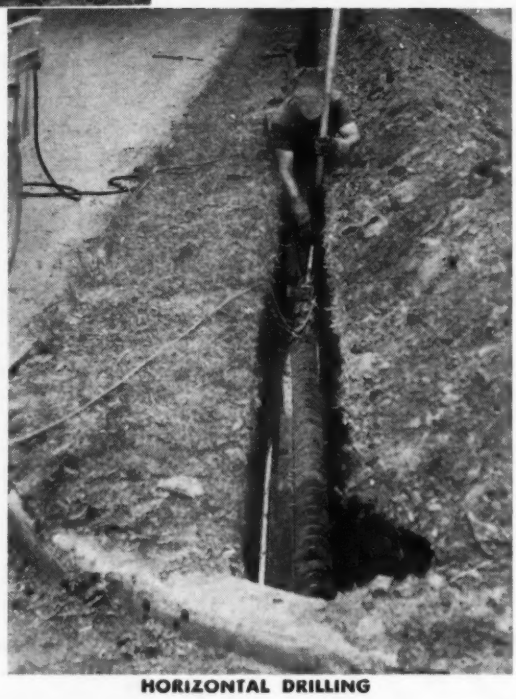

HORIZONTAL DRILLING

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aircraft companies and government agencies. During the war, as head of the Navy ship section, Mr Bish was commercially responsible for all turbines, gears, generators, motors, controls and other electrical equipment for Navy ships of all classes.

C. H. Linder, who has been assistant manager of the Schenectady Works since 1943, has been appointed assistant manager of manufacturing for the apparatus department. Joseph F. Eckel has been made manager of the Lynn River Works. He had been assistant manager since 1945 and is succeeding George M. Stevens, retired.

Transformer Divisions

A general superintendent, and managers of production, engineering and sales for transformer and allied product divisions, have been appointed. H. R. McKean was appointed general superintendent; J. B. Dunn, production manager; F. F. Brand, manager of engineering, and H. F. McRell, manager of sales. All these men have been associated with GE's transformer business.

Mr McKean was assistant general superintendent of manufacturing at the Pittsfield Works; Mr Dunn was assistant production manager of the works; and Mr Brand was works engineer. Mr McRell was manager of the old transformer divisions.

John S. Lennox, well known in electric transmission and station engineering circles and a pioneer in development work on core steels, small dry-type transformers and testing equipments, has retired after 41 years of service. He had served in the testing department, the transformer engineering department, the power transformer commercial section, and as traveling power transformer specialist. From 1941 until his retirement, he also served as general assistant to the sales manager.

GE has consolidated the apparatus office of the Carolinas with headquarters in Charlotte, with R. B. Horning serving as manager to direct operations of the two states. The South Carolina offices previously were included in the Atlanta territory.

Robert W. Adams, assistant district manager of the apparatus department in Boston, has retired. He is planning to engage in some professional work in the future. Mr Adams is well known in the industry as the inventor of a rapid calculator for transmission circuits.

•

► M. C. Turpin, acting secretary of the American Society of Refrigerating Engineers since last June, has been elected secretary of the society. For many years

New...Improvements in PRECISE SURGICAL LIGHTING...PRODUCED BY HOLOPHANE RESEARCH

In the field of surgery, precision lighting is of crucial importance. Holophane engineering has provided outstanding improvements in this specialized illumination. Consider the features that distinguish new Holophane surgical lighting systems from all others:

EFFICIENT . . . Scientific grouping of enclosed multi-lens optics assures maintenance of intense illumination—without sacrifice of correct brightness throughout the entire field of view.

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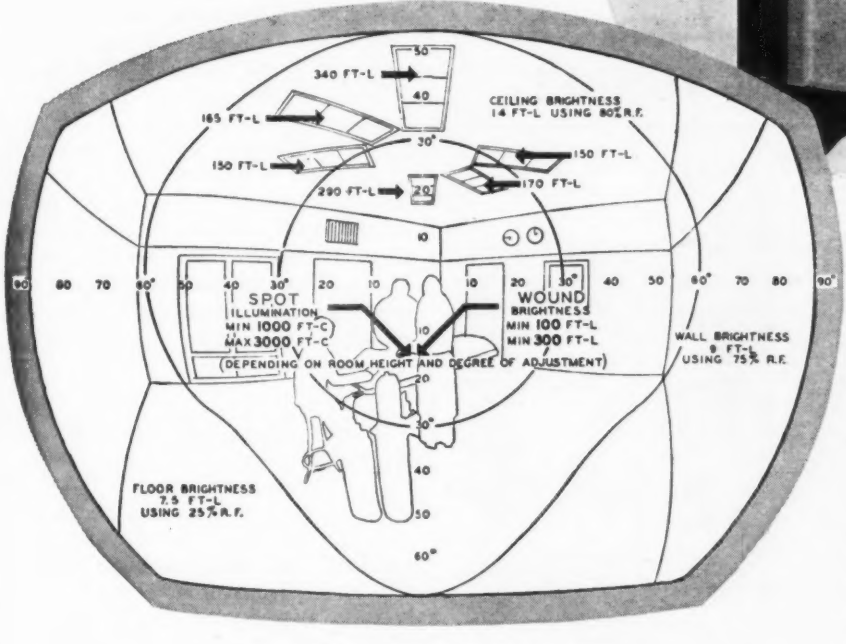
MODERN . . . Direction and pattern of light are pre-set—can be changed, without distracting surgeon, by remote wall switches.



ILLUMINEERING PERSPECTIVE OF A SURGERY
LIGHTED BY 6 HOLOPHANE F-1715-3

VISUAL COMFORT—Diagram at left shows that brightness contrasts throughout the operating room are extremely low. The lenses that could conceivably cross the surgeon's glance are only 1½ times brighter than the minimum wound brightness; are less bright than the maximum wound brightness.

THERMAL COMFORT—No matter what the surgeon's position, lights that his body blocks can be switched off to reduce temperature rise on surgeon's back—important in lengthy operations. In addition, the use of heat-absorbing lenses accomplishes two purposes: reduces the direct infra-red transmission (heat waves) and corrects the light color toward true white.

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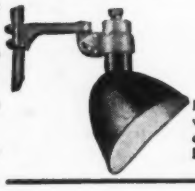

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*145	Clear thermosetting	15–20	45	1.5	30 min. to 6 hrs. @ 250°–350° F.	VM & P Naptha	Coil windings of all types. Armatures, stators, fields, transformers, frames, housings, etc.
1451	Clear thermosetting	40–50	45	2.5	18 min. to 4 hrs. @ 250°–350° F.	VM & P Naptha	
1452	Clear thermosetting	40–50	45	2.0	30 min. to 8 hrs. @ 230°–330° F.	VM & P Naptha	
1454	Clear thermosetting	70–100	45	3.0	12 min. to 2 hrs. @ 250°–350° F.	VM & P Naptha	
175	Clear thermosetting	300–500	75	5.0	35 min. to 8 hrs. @ 250°–350° F.	VM & P Naptha	
245	Black thermosetting	140–160	45	3.0	20 min. to 6 hrs. @ 250°–350° F.	VM & P Naptha	Varnishes adaptable to conventional and conveyorized systems.
300	Clear air drying	40–50	45	2.5	8–10 hrs. @ room temp.	VM & P Naptha	
1457	Clear Baking (Oxidizing-Polymerizing)	35–40	45	2.0	1–8 hrs. @ 275°–330° F.	VM & P Naptha	Apply by: Vacuum impregnation Dipping Brushing Spraying
613	Black Baking & Finishing	40–50	45	3.5	1 hr. @ 260° F. 2 hrs. air dry	VM & P Naptha	
707	Clear Spirit	5–10	25	0.8	25 min. air dry room temp.	Denatured Alcohol	

* Also supplied in 60% solids. †Baking conditions determined by equipment available, size and construction of units treated, properties required in cured varnish film, etc.

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associated with Westinghouse, Mr Turpin had been sales manager in the merchandising department in Washington for 15 years. He was for many years engaged in the preparation of technical literature and articles for the trade press for Westinghouse. He was president of the Electric Institute of Washington, a member of the Washington Board of Trade, and also a charter member and chairman of the Baltimore-Washington section of the ASRE. In addition to his activities as secretary of the society, he is also secretary of all ASRE technical and standards committees.

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► HOMER C. DEFFENBAUGH, who has been associated with electric and gas utilities in New York State for 40 years, has retired. For the past 10 years he occupied the position of rate engineer and market and economic research analyst for the Rochester Gas & Electric Corp. Mr Deffenbaugh obtained his early experience with the Rochester utility and with the Empire State Gas and Electric Association. In 1920 he became engineer in charge of the division of markets and statistics of the New York Water Power Survey undertaken to ascertain the waterpower possibilities of New York State. Returning to the Empire State Association, he spent one year on the staff before rejoining the Rochester utility as manager of the rate and statistical department. From 1931-38 he was connected with the Associated Gas & Electric System as manager of the statistical department, in the latter year assuming the duties he was performing at the time of his retirement. At a luncheon given in his honor by his associates just before he retired, Herman Russell, chairman of the board of RG&E and Alexander M. Beebee, president, paid tribute to Mr Deffenbaugh's service.

► HARVEY E. STEINHOFF has resigned as vice-president in charge of operations, Illinois Power Co, Decatur, Ill. Mr Steinhoff was formerly engineer in charge of design and construction for the North American Light & Power Co in St. Louis from 1935 to 1940; prior to that connection, he was associated with Wisconsin Electric Power Co, Milwaukee, a North American subsidiary.

► C. H. ZURHEIDE has been appointed project engineer in the substations department of the Union Electric Co, St. Louis, Mo. He succeeds FRANKLIN P. ROBINSON, who has resigned to join the staff of the General Electric Atomic Research Project, Hanford, Wash. Mr

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with system planning!

Here's how EBASCO engineers can help you plan the expansion of your system—to serve adequately present and expected loads and be readily adaptable to potential growth and technological advances. They take all factors into account, assuring you minimum overall operating costs and maximum useful life.

EBASCO specialists study your present system, markets, load growth and customer service requirements. They coordinate the planning of required additions and revisions to the three components of the system—*power supply*—*transmission*—*distribution*. They bring a fresh *objective* approach and application of advanced practices to each problem they tackle—along with diversified experience in the development and operation of all types of utility systems and power pools.

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Fresh farm butter . . . without elbow grease

The sloosh-plop-splash-plop of the old hand-turned churn out in the farm house kitchen is almost a forgotten sound these days.

Elbow grease is no longer essential in butter making . . . or many other exacting chores down on the farm. And rural electrification gets the credit!

Much of the power for rural America is carried on lines equipped with Owens-Illinois Power Insulators. These glass insulators, manufactured by a pioneer company, have kept pace with the program of electrification.

Every lot of Owens-Illinois Power Insulators is tested under methods set by American Institute of Electrical Engineers in specifications No. 41-1944 (ASA C29-1944) and by the American Society for Testing Materials, D-730-43T.

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OWENS-ILLINOIS GLASS COMPANY, HEMINGRAY DIVISION, MUNCIE, INDIANA

TRICO
KLIPLOK CLAMPS FOR FUSE CLIPS

Supply the Needed

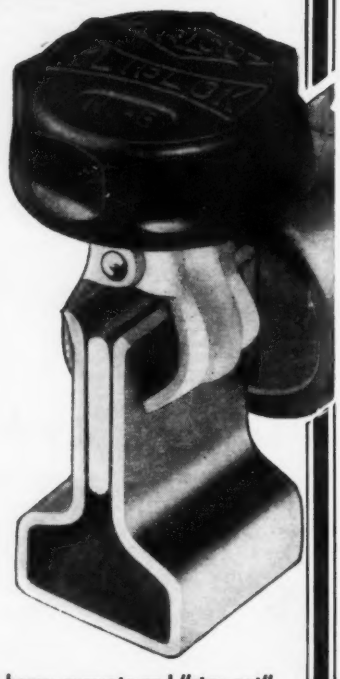
PRESSURE

That Stays & Pays

There's no chance for faulty contact between fuses and clips when TRICO KLIPLOK CLAMPS are applied. The vise-like pressure locks them together—your insurance against damage and destruction of expensive electrical equipment caused by excessive heating.

"KLIPLOKS" ARE A DIVIDEND-PAYING INVESTMENT.

- Stop premature fuse blowings, unnecessary shutdowns and wasted current.
- Eliminate replacement of burnt fuses and clips.
- Reduce fire and accident hazards.
- Give 200% more pressure with less effort.
- Use them on old equipment to stop existing trouble—on new equipment before trouble starts.



WRITE FOR BULLETIN NO. 6-A

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These clamps carry extremely heavy currents and "stay put" when attached. Used for temporary connections, for motor & meter testing, jumpers, etc. Made in 7 sizes—0 to 300 amperes.

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Sherman
SOLDERING LUGS

Zurheide was affiliated with the Laclede Power & Light Co when those properties were acquired by Union Electric in 1945. Mr Robinson had been with Union Electric for more than 7 years.

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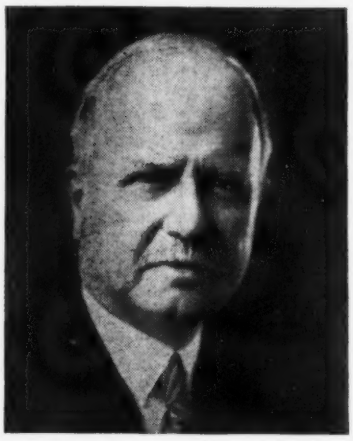
OBITUARY

James G. Biddle

James G. Biddle, founder and chairman of the board of directors of the James G. Biddle Co, Philadelphia, who died recently (EW, Jan 10, page 19), directed his own business for more than



50 years. His career paralleled the amazing growth of the electrical industry. From his intimate knowledge of electrical and scientific instruments, both in this country and abroad, he made many definite contributions, especially in the field of simplified testing devices.

After several years with the then well-known firm of James W. Queen & Co, makers of scientific instruments, Mr Biddle founded his own business in 1895 at a time when the electrical industry was in its early stage of development.

He was responsible for the introduction of many electrical and scientific instruments to this country, being among the first to supply X-ray apparatus. He formed a personal association with scientific and research laboratories, and later with utilities and manufacturing companies. The Biddle company has represented the British firm of Evershed and Vignoles, Ltd since 1910, establishing an American factory in 1943 for the production of these and other electrical instruments.

Widely known in electrical engineering circles, he was a fellow of the AIEE.

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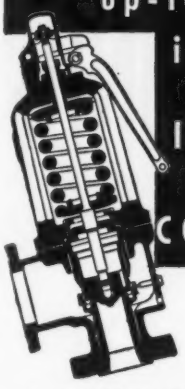
▶ FRED R. CALVERT, 77, former superintendent of the Rockville Power & Light Co, Rockville, Ind., died recently

NOW... up-to-the-minute information on INDICATORS and CONTROLLERS



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16 thorough chapters cover operation and maintenance of indicators and controllers—

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3. Head Meters
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5. Charateristics of Motor-operated Valves
6. Self-operated Pressure Valves
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8. Hygrostats and Psychr. meters
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10. Control Systems
11. Controller Applications
12. Emergency Instruments.
13. Feed-water Control
14. Mechanical Governors
15. Hand Valves and Piping
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Concise analysis of each instrument

This handy manual takes up the mechanical characteristics and efficient operation of each important unit now available, showing cross-sectional views and schematic diagrams to clarify the operation of every part. It includes vital information concerning the physical reactions various controllers introduce into systems—shows you how and where indicators and controllers should be installed for best results.

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Pressure treated Douglas Fir poles have been for years the standard in pole line construction on the West Coast. BAXCO Long-Life Douglas Fir poles meet ASA Specifications and are pressure treated with coal-tar creosote or creosote-pentachlorphenol solution by the empty cell process, 8-lb. retention, in accordance with AWPA Specifications.

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of a cerebral hemorrhage at his home at Crestline, Calif. After leaving the Rockville utility in 1919, Mr Calvert headed his own commercial refrigerator manufacturing organization until 1932 and then was chief engineer of the Monterey Ice & Cold Storage Co, Monterey, Calif., until illness forced him to retire in 1934.

▶ ARTHUR S. KNIGHT, 85, distinguished consultant on rates in the public utility field, died at Boston, Mass., on Jan 6. He joined the then Edison Company for Isolated Lighting in Boston as an assistant bookkeeper in 1882. Mr Knight was associated with the famous Bijou Theater lighting at Boston in that year under the supervision of Thomas A. Edison. Long a member of the Edison Pioneers, he was an incorporator of the Edison Electric Illuminating Co of Boston. From 1892 to 1901 he was its auditor, later serving as comptroller. Engaging in private practice, Mr Knight was retained by the Edison company as rate consultant until his retirement in 1935. He was chairman of that utility's rate committee for 15 years.

▶ POWELL L. PAXTON, formerly identified with the electric utility industry, died suddenly in Buena Vista, Va., on January 4 at the age of 47. A graduate of the Virginia Military Institute, Mr Paxton was associated with the Central Hudson Gas & Electric Co at Poughkeepsie, N. Y., and later with what was then the Virginia Public Service Co at Alexandria, now Virginia Electric & Power Co. Before returning to his native state, Virginia, he was identified with the L. E. Myers Co in Dallas, Tex.

▶ EDWARD T. INGHAM, advertising manager of the American Brass Co until his retirement 4 years ago, died in Torrington, Conn., on Jan 3 after a long illness. He was 72 years old. Mr Ingham joined American Brass shortly after his graduation from Yale University in 1900 and for a while was employed at the company's plant at Kenosha, Wis.

▶ M. REESE HATTABAUGH, for many years an Idaho public official and prominent attorney, died in Boise on December 23 at the age of 70. He served 12 years as a member of the Idaho Public Utilities Commission.

▶ CLARENCE V. ROBERTS, who retired in 1944 as president of the Roberts & Mander Stove Co, Hatboro, Pa., died on Jan 4 at his home in Philadelphia. He was 85 years old. Mr Roberts founded the stove company in 1903.

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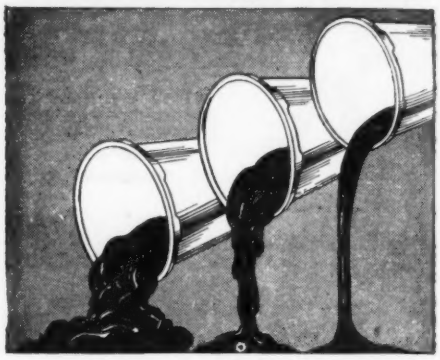
COMPOUNDS
of Record-Breaking Performance



Minerallac gives you a complete assortment for every need: dense, viscous and fluid consistencies for high and low voltages in cable-joints, pot-heads, terminal bills, distribution cables, street lighting, telephone work. . . . Insoluble in oil or water, for all temperatures. Clean, safe, economical—outranks all others in quality.

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Complete Plants • Additions • Installations
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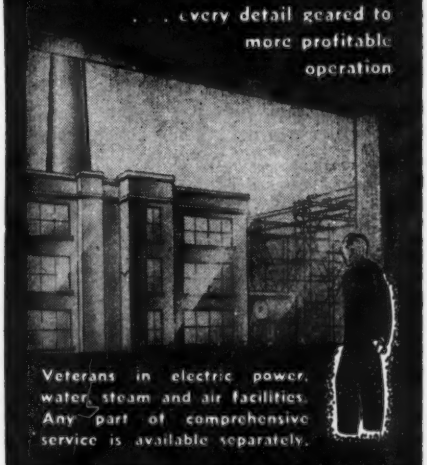

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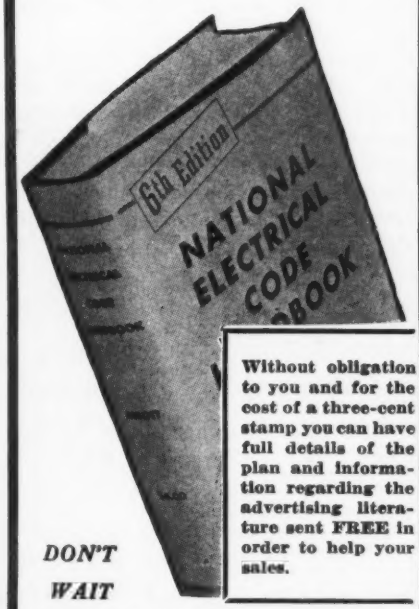

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DOSSERT BOLTLESS CONNECTORS

(Patent No. 2198964)

FOR CONNECTING TUBULAR BUSES QUICKLY . . . ECONOMICALLY

A new, unique type of no-bolt connector. Saves time, labor and money by eliminating troublesome, time-wasting tightening and taping of old-fashioned clamp-type connectors. Easily and quickly installed.

High-pressure, internal-expansion connectors provide permanent, vibration-proof grip on tubing.

Assure a smooth, streamline connection, without bulkiness.

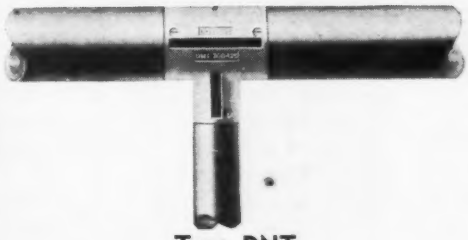
High conductivity copper alloy construction throughout.

Safe . . . trouble-free service . . . minimum maintenance.

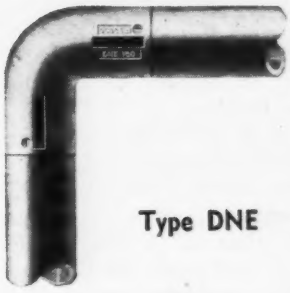
Precision-built to the DOSSERT standard of engineering, craftsmanship and quality.

Type DNC

Type DNR



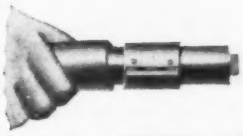
Type DNT



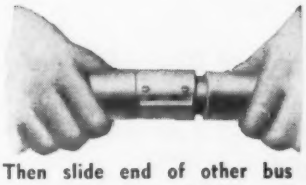
Type DNE

INSTALLED IN A JIFFY!

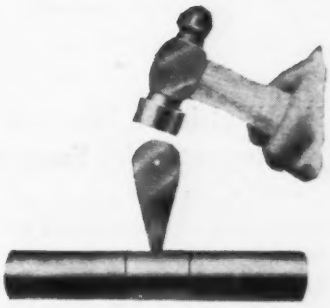
Supplied as a single unit, already for COMPLETE INSTALLATION.



A. Simply slide DOSSERT BOLTLESS Connector into an end of tubular bus.



B. Then slide end of other bus over connector up to shoulder of connector.



C. Only several hammer blows on the key. Lock by screwing in set screws with pointed end of same key.

D. Connection is complete, streamlined, and secure. (Disassembled just as quickly).

Full particulars upon request to Dept. 17.

DOSSERT MFG. CORP.
249-255 HURON STREET, BROOKLYN 22, N. Y.
SINCE 1904

MANUFACTURERS & MARKETS

Ohio Crankshaft Purchases Budd Co Heating Unit

Purchase of the induction heating division of the Budd Co (located in Detroit, Mich.) by the Ohio Crankshaft Co for its Tocco Division, has been jointly announced by Edward G. Budd, Jr, president of The Budd Co and W. C. Dunn, president of Ohio Crankshaft. The purchase includes machinery, equipment, inventories and patents, but not the land or buildings.

The Tocco Division, which is located in Cleveland, has announced the addition of an engineering department to its Chicago office. By establishing complete engineering facilities as an integral part of the Chicago office, the division will be able to offer improved service to industries in the Middle West on all phases of induction heating applications.

L. C. Schweitzer remains as Chicago district manager in charge of all activities. A. O. Wood, who has been closely associated with the Tocco process from the time of its original development, has been made district engineer. The staff has been increased to include commercial, service and sales engineers.

•

Big Watthour Meter Backlog Reported by Sangamo Co

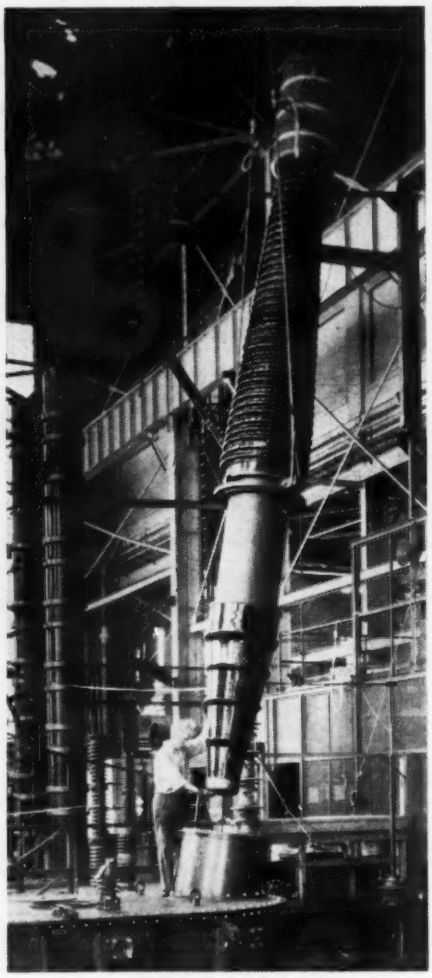
"Our backlog of orders for watthour meters indicates we will be under pressure for shipments through the first 9 months of 1948," said Don Funk, president of the Sangamo Electric Co, Springfield, Ill.

"We cannot, however, expect to continue indefinitely at our present rate of production. Our other products have a satisfactory outlook for the new year but carry no such backlog as exists in the field of watthour meters."

•

Motor Output at New High

Electric motor production at the Ohio Electric Mfg Co has reached an all-time high, Chester Bland, president, has revealed. Daily output is now 1,200 motors. Total October production, Mr Bland said, exceeded 25,000 motors.



LARGEST TRANSFORMER bushing ever built by General Electric Co is being lowered into an experimental transformer at the company's Pittsfield, Mass., Apparatus Works. The 26-ft-long bushing and the transformer have a voltage rating of 360,000 v. Previous high was 287,000 v units for Hoover Dam

Orders Rise 10 Percent

Incoming business of Continental Diamond Fibre Co during the third quarter of 1947 was about 10 percent larger than second quarter orders, Norris N. Wright, president, said at a special meeting of stockholders. The company has a backlog of more than $5,000,000 he said. Stockholders approved a retirement plan for full-time salaried employees.

Elmira Foundry Made Part of GE Apparatus Dept

The Elmira Foundry Co, Inc, of Elmira, N. Y., has been made an integral part of the General Electric Co. Dissolution of the corporation, heretofore a GE affiliate, became effective Jan 2.

Under the reorganization, the foundry becomes one of 9 major works and 24 factories composing the apparatus department. Ralph H. Roberts, who has been manager of the foundry company since 1946, continues as manager of the Elmira Works.

The foundry produced more than 50,000,000 lbs of grey-iron castings in 1947, according to Mr Roberts, who said the plant would produce a wide variety of parts for General Electric products. Employment at the plant exceeds 900 persons, including 43 foremen and supervisors.

Announcement of the change of status for the Elmira plant comes as a $1,500,000 plant expansion program, started in 1946, nears completion. In addition to increasing the capacity of the foundry by 45 percent, the program involves improvement of ventilation and lighting facilities.

•

Line Material Co Assumes Ownership of Kyle Corp

Unification of ownership of the Kyle Corp, South Milwaukee, Wis., with the Line Material Co of Milwaukee has been announced.

Operating under the name of Kyle Co, a division of Line Material Co, the Kyle organization will continue to label and sell their line protection equipment under the Kyle name. As in the past, some Kyle products will be sold through the branches and representatives of Line Material.

No change in operations, general policies, or responsibilities of present Kyle personnel is anticipated.

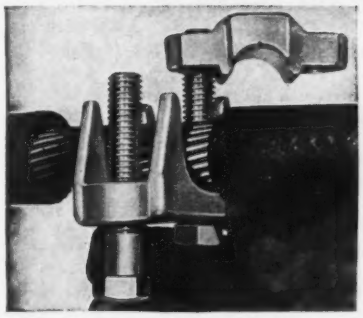
•

Lighting Educational Course

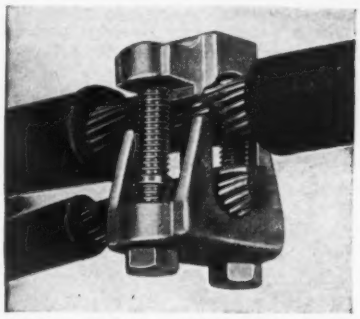
Any individual film and record of the 18 comprising the Westinghouse Lighting Educational Course for training of lighting sales personnel may now be

More Efficient Connectors For Large Conductors

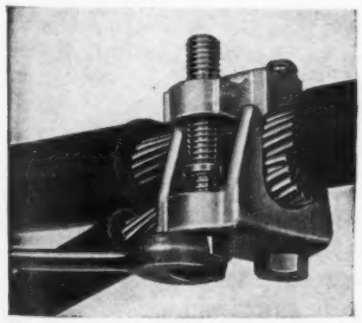
Save Up To Half Your Cost



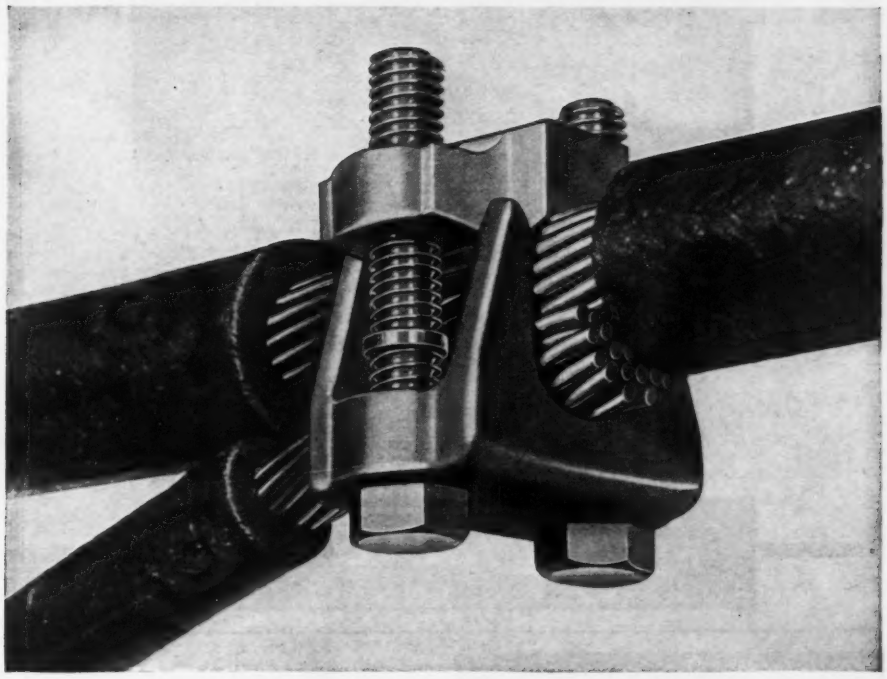
After fitting connector on conductor as above, place upper clamping member in position as shown below and partially thread free cap screw into it.



With connector in position on conductor as shown, install tap-off wire and equally draw up cap screws.



Continue to draw up cap screws until connector is securely tightened. Note easy access of wrench to heads of cap screws.



MATTHEWS UNICLAMP CONNECTORS

U. S. PATENT 2,426,857

You can cut your initial costs on large size wire connections up to 50% by using Matthews Uniclamp Connectors.

You can get them for 1/0, 2/0, 4/0, 350 MCM, 500 MCM and 750 to 1000 MCM stranded copper wire—or 1 ACSR to 1033 MCM ACSR aluminum wire. They can be furnished for copper to copper, aluminum to aluminum, or aluminum to copper and other bi-metal connections. You can install any size with an eight inch wrench and get permanently tight and trouble free connections. They will accommodate two conductors of their rated size or one of rated size with one or more smaller tap-off wires as small as 8 solid. They can also be easily installed by means of hot line tools. You will note the large contact surfaces of the silicon bronze castings and the large strong Duronze cap screws. They are the reasons for better connections; no loosening of connectors; no overheating or burning of connections; less friction due to strong, but small diameter bolts, hence greater pressures on conductors than for corresponding split bolt sizes; they will cost you up to 50% less than comparable sizes of split bolt connectors.

The **one-piece-to-handle** feature is strongly patented and the name Uniclamp is copyrighted. Use genuine Uniclamps and get all the above advantages.

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purchased separately, the company has announced. The cost of the complete kit, 18 sound slide films and recordings, one instructor's manual, ten sets of lesson books, and one lighting handbook, is $225. The cost of any individual film is $12; record, $5; lesson book, 20 cents; instructor's manual, $1; and, of the lighting handbook, $2. These are available from Westinghouse Lamp Division offices in New York, Philadelphia, Atlanta, Pittsburgh, Chicago, St. Louis and San Francisco.

•

Manufacturers Make Sales Assignments

Electrical manufacturing companies have recently made the following appointments to their sales staffs:

RELIANCE ELECTRIC & ENGINEERING Co has appointed William C. Madsen branch manager of the Gary, Ind., office. He succeeds H. J. Thompson, who has become district sales representative in Gary for the electrical manufacturing division of the National Acme Co. Reliance has also named William A. Metcalf as sales representative in the Kansas City territory. Mr Metcalf is associated with Carl P. Lohr Co, which has represented Reliance Electric & Engineering in the St. Louis area for the past 15 years.

HOTPOINT, INC, has appointed Donald W. Rennewanz manager of Pacific sales district, San Francisco. In this assignment, Mr Rennewanz is responsible for all sales activities in the 11 western states of the country.

E. INGRAHAM CO, Bristol, Conn., has appointed Hermon P. Haynes district manager for the West Coast district and Theodore H. Klein for the district covering northern Illinois, Wisconsin, Minnesota and North and South Dakota.

•

Manufacturers Issue Earnings Reports

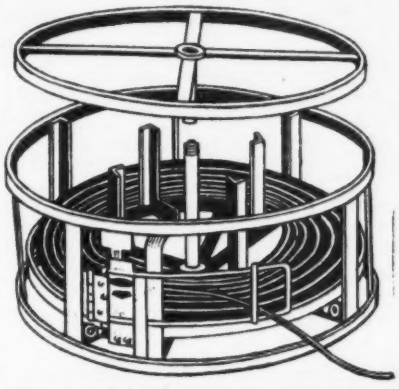
Among the electrical manufacturing companies that have recently issued statements of earnings are the following:

LEECE-NEVILLE—Net sales, $3,570,641 in fiscal year ended July 31, 1947. Net profit after taxes totaled $93,711, equivalent to 41½ cents per share. This compares with a net loss, in the 1946 year, of $128,248. The company entered the 1948 fiscal year with a $2,500,000 backlog of orders.

CENTURY ELECTRIC—Nine months ended Sept 30, net profit of $1,926,851 after taxes and charges and provision of $200,000 for inventory reserve, equal to $3.85 a share on 499,655 capital shares. Net sales for the period amounted to $16,097,169.

ELLIOTT CO—Nine months ended September 30, net profit, $975,961 on sales of $14,101,419, equal to $2.75 a share on the common stock. This compares with a loss of $235,100 on sales of $6,880,685 for the nine months ended Sept. 30, 1946.

WIRE CAN'T GET TANGLED OR FOULED



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Adjustable from 10 to 34 in.

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MEGOHM AND OHM RANGES!
COMPARE
The New MODEL B-7
MEGOHMER
with any other insulation tester. See the difference. More scale divisions, longer aggregate scale, easier to use, no cranking, saves time and effort, reads as low as 1/10 of one Ohm to 200 Megohms. Two test potentials 250/500 volts. 0-20/200 Megohms, 0-200/20,000 Ohms. Bulletin No. 440 EW.

HERMAN H. STICHT CO., INC.
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CONSTRUCTION

NEW ELECTRICAL construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is included

UTILITIES

Proposed Construction

Colorado—Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, furnishing f. o. b. cars shipping point or f. o. b. cars Loveland, one control switchboard, AC-DC control and power distr. switchboard; two 3-kw, 125-volt battery charges, supervisory control and telemetering equip. for controlling the Marys Lake Power Plant from the Estes Power Plant; two 450 kva, 7,200 delta to 480 wye-volt transformers; one 37½ kva transformer, complete with induction-type voltage regulator, for Marys Lake Power Plant, Colorado-Big Thompson Proj., Spec. 2072. Plans deposit $2.50. Walker R. Young, Denver, ch. engr.

Georgia — Sumter Electric Membership Corp., Americus, imprv. sys., completing previously approved construction and 358 mi. rural distr. lines, Sumter Co. **$620,000.**

Ind., Fort Wayne — Indiana Service Corp., J. C. Hill, vice pres. 2101 Spy Ran, sub-station imprvs., incl. 50,000 kw. transformers. **$600,000.**

Ia., Lenox — Bd. Trustees Municipal Electric plant, Lenox, power plant addn., incl. diesel engine generating unit 400 to 500 hp., exciter, silencer, foundation, piping, auxiliaries, cooling tower, concrete pit, circulating pump, 20 x 26 ft. bldg. addn., 2 switchboard panels, etc. Plans deposit $10. Harold Hoskins & Assocs., Inc., 231 N. 11 St., Lincoln, Neb., engr.

Missouri — Howell-Oregon Electric Cooperative Inc., West Plains, 67 mi. rural distr. lines, 4 sub-stations, etc., Howell Co. **$785,000.** F. Horton & Co., Lamar, consult. engrs.

Nebraska — Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., furnishing del. f. o. b. cars shipping point or f.o.b. cars Bridgeport, four 3,300 kva. one 10,000 kva. and one 25 kva. transformers, regulators, reactors, circuit breakers, disconnecting switches, disconnecting fuses and transformers, for Bridgeport Substation Power Transmission Lines Unit, Nebraska, Missouri Basin Project. Spec. 2043. Plans deposit $1.75.

Nebraska—Custer Public Power Dist., Broken Bow, constructing C section, 450 mi. rural distr. lines, Custer, Lincoln and Logan Counties, hired labor. **$450,000.** Homer Loutzenheiser, mgr. and ch. engr.

N. C., Gastonia—City, H. Rutter, mgr., electrical imprvs., six 150 kv-a. 2400 primary 2400 volt secondary oil-immersed, 60 cycle insulating transformers for installation in 4160/2400 volt wye connected primary with a delta connected secondary, each transformer to have four 2½% below normal, full kva. capacity primary taps. Platt & Davis, Box 971, Durham, engrs.

Oregon—Bonneville Power Admin., 1300 N. E. Union St., Portland, constructing Drain substation control house and outdoor switching station, Proj. No. 4117. Plans deposit $25.

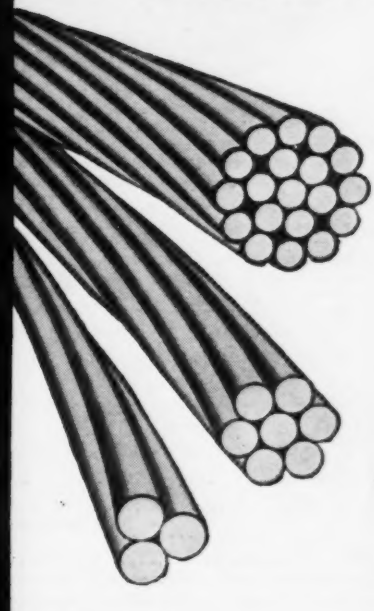
Texas—Lower Colorado River Electric Co-operative, Gliddings, addnl. rural distr. lines, Lee Co. **$380,000.**

Tex., Brownwood—Texas Power & Light Co., Interurban Bldg., Dallas, electric power plant. **$800,000.**

Washington—Bureau Reclamation, Dpt. Interior, Building 1-A, Denver Federal Center, Denver, Colo., Dec. 30, three 165,000 hp. turbines in Grand Coulee Power Plant, Columbia Basin Project, Spec. 2011, from Newport News Shipbuilding & Drydock Co., Newport News, Va. **$2,570,000.**

Wyoming — Bureau Reclamation, Dpt. Interior, Building 1-A, Denver Federal Center, Denver, Colo., constructing Medicine Bow-Hanna and Glendo-Lusk 34.5 kilovolt transmission lines, Kendrick Proj. Power Transmission Lines Unit, Missouri Basin Proj., Spec. 2071.

PAGE
Stainless Steel
STRAND



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Here's a combination heater-fan that's safe, even in a nursery. Both fan and heating element are completely screened to protect precious baby fingers. You can sell the HOWARD with confidence.

The HOWARD works on new air-flow principles, gives your customers two useful units for the price of one. They get no-blast heating when the snow flies . . no-draft air cooling when the temperature soars. This combination makes the HOWARD a "natural" for you.

Hot or cold air rushes upward against a scientifically engineered metal cone that starts radiations to all corners of any room. The result is a gentle, even ripple that develops cozy warmth in winter and fresh coolness in summer.

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The HOWARD is quiet as a summer breeze, easy to carry as a shopping bag. And its streamlined styling catches customers for you.

Cash in on the profit possibilities of this Collier's-advertised heater-fan that retails at only $24.95, plus $1.19 F.E.T. Order through your local jobber or fill out the coupon below:

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Model A-1 HOWARD Combination Heater-Fans @ $17.35 (tax included). $..... ... (Total)
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ADDRESS.....
CITY.....STATE.....
Signature.....

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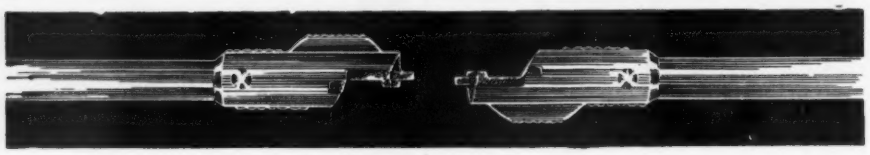
231 S. LASALLE STREET, CHICAGO 4, ILLINOIS



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CONDUIT RODS
STRONG . . . LIGHTWEIGHT . . . EASY TO WORK WITH . . . TIGHT-LOCKING . . . NO MALE AND FEMALE JOINTS . . . EACH COUPLER IDENTICAL . . . *WRITE TODAY FOR DETAILS AND PRICES.*

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A high grade fibre board for electrical insulation. A material of quality possessing high tensile and dielectric strength. Used by many of the leading manufacturers of electrical equipment.

DENSITE
An extremely hard board of superior quality which can replace the more expensive types of insulating materials.

Pulp Products Department
WEST VIRGINIA PULP & PAPER COMPANY
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Low Bidders & Contracts Awarded

California — Bureau Reclamation, Dpt. Interior, Bldg. 1-A, Denver Federal Center, Denver, Colo., constructing Parker Dam-Pilot Knob 161 kv transmission line, Davis Dam Proj., Schedule 1, Aluminum conductor, Spec. 1910, to J. & J. Constr. Co., First National Bank Bldg., Oklahoma City, Okla. **$1,213,498.** Bids 9/25.

Ga., Albany—Georgia Power Co., 78 Marietta St. N. W., Atlanta, powerhouse superstructure for Plant Mitchell, to Blythe Bros. Co., Box 989, Charlotte, N. C. Est. over **$100,000.** Bids 12/15, awarded 12/29.

Iowa—Southern Iowa Electric Co-operative, Bloomfield, 155 mi. rural distr. lines, Davis Co., own forces; power generating plant, to R. V. Leary & Co., 744 35 St., Des Moines. Est. **$255,000.** Proposed Work published Dec. 27, issue, p. 22.

Ia., Eldora—City, municipal light and power plant, to Fayre Constr. Co., Esterville, **$84,540*****3 diesel engines and equip., to Enterprise Eng. & Foundry Co., 18 and Florida Sts., San Francisco, Calif., **$175,933*****distr. sys., to G. Schugman, Abingdon, **$169,633.** Grand total $430,106. Bids 12/17, awarded 12/25. Proposed Work published Nov. 29, p. 22.

Ia., Lake Park—City, c/o City Clerk, two 314 hp. diesel engine generating units, switchboard, station wiring, distr. sys. and street lighting, etc., to Buckeye Machinery Co., Lima, O. **$140,029.** Bids 12/15.

Neb., Wilber—City, municipal electrical system imprvs., incl. changes in plant bldg., generating units, wiring, etc., to Fairbanks-Morse Co., 9 and Harney Sts., Omaha. **$118,374.** Bids 12/22.

Wash., Seattle—University of Washington, Henry Bldg., Zone 1, complete electrical work in utility tunnel from City Electric Co., 3 Ave. and Spring St., Zone 4. **$111,760.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Calif., San Francisco—Stoneson Bros., 1 Sloat Blvd., plans by Angus McSweeney, 514 Mission St., community development, incl. twenty-six 7 and 8 story apartments, in 2,000 seat theatre, medical bldg., shopping center, on 19 Ave. north of Park Merced. **$30,000,000.**

Ia., Iowa City—U. S. Eng., Clock Tower Bldg., Rock Island, Ill., 10 story, penthouse, 190 x 380 ft., 500-bed, steel, limestone veterans hospital, auxiliary bldgs. for doctors, nurses, and attendants, power plant and laundry bldg., for Veterans Admin., Vermont Ave. between H and I Sts. N. W., Wash. 25, D. C., $8,000,000.

N. Y., New York—Sydenham Hospital, Manhattan Ave. and 123 St., plans by William Lescaze, 211 E. 48 St., Zone 17, 10 story hospital adjoining present hospital to house a Research Institute of Medical and Related Sciences and an Institute of Community Relations. **$7,500,000.**

N. Y., Yonkers—Arthur Cutler, 1440 Broadway, New York, Zone 18, plans by Nathan Harris, 1560 Broadway, New York, Zone 19, 1,000 family garden apartment center on 103 acre tract Central Ave. and Christfeld St. **$10,000,000.**

Tenn., Oak Ridge—U. S. Atomic Energy Comn., Oak Ridge, metallurgical lab. bldg. and altering Biological Bldgs. **$2,000,000.** Patchen & Zimmerman, Augusta, Ga., consult. engrs.

Low Bidders & Contracts Awarded

La., Baton Rouge—Valley View Apartments, Inc., c/o contractor, apartment development, to J. A. Jones Constr. Co., 209 W. 4 St., Charlotte, N. C. Est. **$2,000,000.**

La., Shreveport — Valley View Apts., Inc., c/o contractor, apartment development, to J. A. Jones Constr. Co., 209 W. 4 St., Charlotte, N. C. Est. **$2,000,000.**

N. Y., New Rochelle — New Rochelle Housing Auth., 271 North Ave., Winyah Gardens Housing, to J. A. Johnson & Sons, 268 41 St., Brooklyn. **$1,644,000.** Proposed Work published Dec. 20 p. 116.

Tex., Big Spring—U. S. Eng., War Dpt., Albuquerque, N. M., 250 bed general medical and surgical hospital, for Veterans Admin., Vermont Ave. between H and I Sts. N. W., Wash. 25, D. C., Robert E. McKee, 1918 Texas St., El Paso. **$5,712,739.** Bids 1/5.

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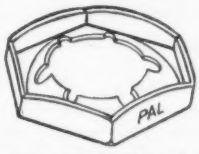

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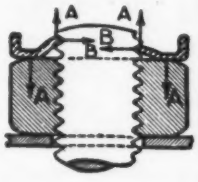

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BOOK REVIEWS

IES Lighting Handbook. Published by the Illuminating Engineering Society, New York. 850 pages, illustrated. Price $7.50.

In simple and condensed terms this book sets forth the present state of the lighting art, evaluated and interpreted by over 100 specialists. In its reference division, it covers the physics of light production, light and vision, standards, nomenclature, abbreviations, color, measurement, light sources, light control, calculations, and day lighting. On light applications, discussions cover lighting of interiors, exteriors, sports, and transportation; also photographic reproduction, projection and television lighting, as well as applications of minature lamps and of radiant energy. Included is a voluminous appendix of tabulated data and formulas of lighting specifications and mathematics. The volume concludes with 187 pages of manufacturers' reference data.

The Electrical Appliance Sales Handbook. By Laurence Wray. Published by McGraw-Hill Book Co, New York. 231 pages. Price, $3.50.

A manual of sales arguments for electrical applications in the home and on the farm. Advantages of electric water heating, cooking and refrigeration over competitive methods—bottled gas and coal—are recited in detail. Electric water supply systems, food freezing, laundry work, cleaning, farm work applications, and adequate wiring are discussed at length. The appliance dealer and salesman will find in this book a wealth of selling information.

Electric Contacts. By Ragmar Holm. Published Almqvist & Wiksells Aka demiska Handboecker, Stockholm, Sweden. 398 pages, illustrated.

This is a smooth English translation of a mathematical physicist's analysis of the phenomena involved in contact behavior. Explanation of the variants arising from surface irregularities, pressure and temperature effects and current dispersion is amply graspable by engineers. So is the discussion of tarnish and conduction through thin films and the dry rectifier. Of more direct interest should be the analysis of the sliding contact involved in switches, including the incidence of friction and wear. Other practical operations like carbon brushes, the short arc, bouncing contacts, are treated in the light of the fundamentals with which the book begins.

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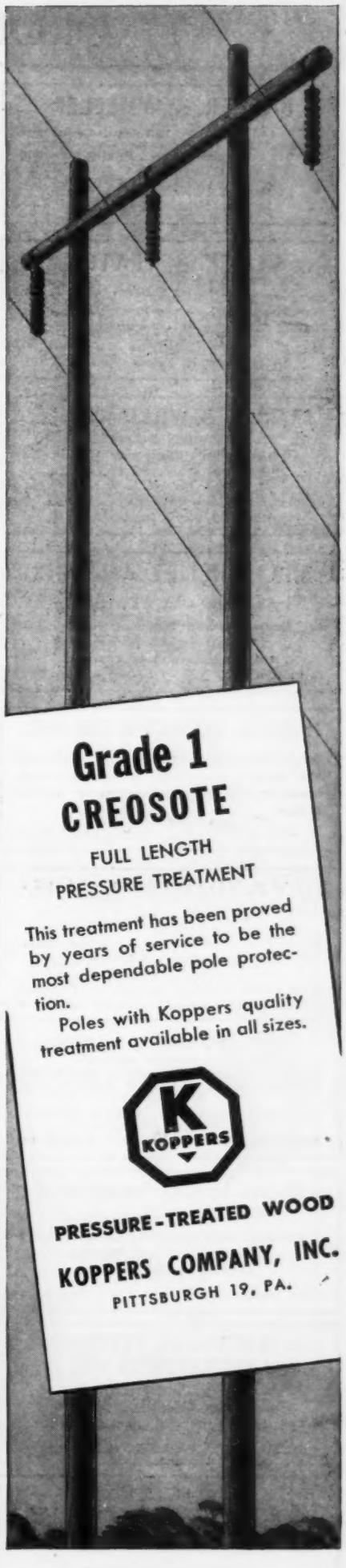

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Continued on page 240

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LETTER TO THE EDITOR

Appeal of Utility Employment

To the Editor of ELECTRICAL WORLD:

It appears to me that utility officials and college professors overlook some of the things that tend to make the utility business comparatively unattractive to young engineers.

In the first place, the colleges often give students the impression that if they get a technical education, they will have the world by the tail. Then the students come to work, all starry-eyed and ambitious, and what happens? We put them on the lowliest and dirtiest work we have, which requires no education at all. There is nothing wrong with this. They are not experienced in anything on a higher level. But they have the wrong viewpoint. Instead of becoming vice-presidents within a few months, they begin to see that they will be several years working up to the grade of substation operator, or to the position of assistant to some minor engineer. This is quite a shock to the young man, and he drops out very soon if he can land something more to his liking.

But the utility industry has been just as far wrong. While it offers opportunity, advancement is bound to be slow. It has been a fairly stable industry as far as employment is concerned. But the utilities have never been big pay industries. Utilities have been more concerned about reducing costs and rates than they have about paying their employees enough to make the jobs attractive. The glamor in utility engineering work in past years has been mostly the fascination of technical developments. Since most all technical development work is now done by manufacturers, and others outside of the utility industry, the work of the utility engineer is mostly routine.

With the present day set-up, the young engineer knows that when he reaches a certain age with the utility he will be thrown out on his ear.

The owners and officials of utility companies have never done much to defend the industry against the "smearing" attacks of politicians. They have never done much to foster and promote better public relations. The young man probably had a very bad opinion of the industry before he ever got to college, and he still has it. The utility industry has done some wonderful things in the 45 years I have known it. It can make engineering work as attractive as anywhere else. Why not do it?

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(Continued from page 239)

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